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MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

NEW AND RARE INDIAN ODONATA IN THE PUSA COLLECTION

BY

MAJOR F. C. FRASER, I.M.S

AGRICULTURAL RESEARCH INSTITUTE, PUSA

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NEW AND RARE INDIAN ODONATA IN THE PUSA COLLECTION.

BY

MAJOR F. C. FRASER, I.M.S.

[Received for publication on 22nd September 1921.]

SUB-ORDER ZYGOPTERA.

FAMILY CŒNAGRIONIDÆ.

Sub-family Protoneurinæ.

Drepanosticta viridis, sp. nov.

Two males (in spirit), King Island, Mergui, Burma, 4th June 1921, collected by J. R. Elton Bott. One female (in paper, teneral) from the same locality and most probably related to the two males.

Male. Abdomen 50 mm. Hindwing 25 mm.

Head. Eyes pale yellow, capped broadly above with puce ; labium white ; labrum and anteclypeus white, the former bordered narrowly with jet black ; rest of head metallic blue.

Prothorax a dirty yellow, unmarked except for the posterior lobe which is transversely elongate and dark brown.

Thorax metallic green on the dorsum, pale reddish brown subdorsally and dirty yellow on the sides ; two obscure brownish stripes on the lateral sutures.

Legs yellowish, striped with black.

Wings hyaline : stigma reddish brown, its costal border much shorter than its posterior and its lateral borders rounded. Postnodal nervures to forewing 14 to 15, 14 in the hind. *Ab* runs between the posterior margin of the wing, just distal to *ac*, and the underside of the quadrilateral.

Abdomen extremely elongated and attenuated, dilating at segments 8 to 10. Segments 1 to 7 brownish, this colour deepening at the apices and not quite extending to the extreme base, so that a small, whitish annule is left. Segments 8 and 9 are a beautiful sky-blue which on the former is replaced on the basal half or third by black ; the black extends into the blue on the middorsum and wraps around it at the side so that the blue forms two points directed basally. Segment 10 is all black.

Anal appendages of striking shape. The superior bent at their middle to a full right angle, the apical half bending down abruptly and with the apex shortly and bluntly bifid ; at the angle, on the dorsal surface, is a fine, needle-like spine. Inferior appendages stout at the base, narrowing abruptly at their middle and then tapering and curling up like a sickle.

The ends of the superior lie between the two inferior prongs ; the former black, the latter white.

Female. Abdomen 37 mm. Hindwing 25 mm.

Much shorter and more stoutly built than the male. Very similar to the male in colouring, but there is no blue on segments 8 and 9 ; the white annules are well defined on segments 1 to 6 and the brown on the body generally is of a deeper shade. The dorsum of the thorax is metallic green as in the male.

Habitat. Swamps and running streams in a three-year old rubber plantation.

From *Drepanosticta carmichaeli* this species is easily distinguished by the metallic colouring on the dorsum of the thorax and by not having blue humeral stripes.

Type (male) in the Pusa collection.

Caconeura theebawi, sp. nov.

Two males from King Island, Mergui, Burma, 4th June 1921, collected by J. R. Elton Bott.

Male. Abdomen 29 mm. Hindwing 19 mm.

Head black, marked with purplish blue as follows :—a transverse stripe at the level of the ocelli, the base of the labrum, the labial palps and the cheeks. Eyes black above, dove-grey beneath.

Prothorax black with a purplish blue stripe along each side. Posterior lobe scale-like, quadrate, simple.

Thorax black, marked with purplish blue as follows :—a narrow, ante-humeral stripe narrowing gradually from below upwards and not extending

as far as the alar sinus, a lateral, moderately broad stripe, and the posterior part of the metepimeron.

Legs black.

Wings hyaline : stigma blackish brown, its inner border considerably shorter than the outer, 15 postnodal nervures to the forewing, 13 in the hind ; Cu^2 4 cells long in the forewing, 5 in the hind ; *ab* entirely absent in all wings.

Abdomen black, marked with blue as follows :—a large, subtriangular spot on the sides of segment 1 ; a streak on the lower part of the sides of segment 2 and a triangular, apical, subdorsal spot ; segments 3 to 5 have small, dorsal, basal spots, segments 9 and 10, which are strongly keeled, are entirely blue except for the extreme lower edge.

Anal appendages. Superior broad at the base, truncate afterwards and somewhat quadrate at the ends when viewed in profile, furnished below at the apex with a robust, black spine ; viewed from above they appear to be triangular and conical, purplish blue ; inferior broad at the base, tapering rapidly, the ends curling in and overlapping one another slightly, white tipped with black.

Female. Abdomen 28 mm. Hindwing 18 mm. Postnodals to forewing 16.

Very similar to the male, but the blue markings more restricted and less purplish in hue. The antehumeral lines very narrow and the lateral more so than in the male.

The sides of the abdominal segments 3 to 5 show indications of a fine blue line surmounting a paler brown area ; segments 8 and 9 have a continuous blue, lateral line and a dorsal streak of blue which expands abruptly at the apex, but does not extend as far as the apical border ; in either segment this marking is shaped like a vase with a long neck ; segment 10 has a quadrate blue spot on the dorsum.

Anal appendages blue, as in the male.

Habitat. As for *C. nigra.*

Type (male) in the Pusa collection.

Note. I am doubtful as to whether species of *Caconeura* which have entirely lost the nervure *ab* should not be placed in a genus of their own. I have examined large numbers of *Caconeura* and, where *ab* is vestigial, have always found it present in all wings. On the other hand I have never found a vestige of *ab* in any wing of a species where it is normally absent. This feature seems to be constant in species, *ab* either being present in its entirety as in *Disparoneura*, as a vestige as in *Caconeura*, or absent entirely as in the present species.

Caconeura botti, sp. nov.

Several males from King Island, Mergui, Burma, 4th June 1921, collected by J. R. Elton Bott.

Male. Abdomen 31 mm. Hindwing 19 mm.

Head black traversed above by a broad band of azure blue at the level of the ocelli ; the cheeks, lateral lobes of labrum and labrum are also blue, but the base of the latter is black ; eyes pale blue or greyish blue, the upper half capped with brownish black.

Prothorax black, the posterior lobe and a large subdorsal spot azure blue. The posterior lobe is very large but simple.

Thorax black marked with very broad, triangular, antehumeral, azure blue bands which are rounded below and taper towards the alar sinus ; laterally there is a moderately broad, blue stripe and the lower, posterior part of the metepimeron is of a paler whitish blue ; beneath white.

Legs black, paler at the bases of the femora and coxæ.

Wings faintly enfumed : stigma lozenge-shaped, black, braced ; postnodal nervures in forewing 16 to 17, in the hind 14 ; *ab* vestigial and enclosing with the posterior border of the wing a very small marginal cell.

Abdomen black ; segment 1 with a spot of pale blue at the side ; segment 2 with a stripe of the same colour on the side followed by a paler spot at its apical end ; segments 3 and 4 with small, basal, dorsal, pale blue spots ; the remainder black.

Anal appendages of the usual generic shape, but the inferior longer than usual and more tapering, the extreme apices being slightly upturned. The superior azure blue and apparently serving as recognition marks ; the inferior white tipped with black.

Female unknown.

Habitat. Collected on the banks of a running stream in a three-year old rubber plantation.

Type in the Pusa collection.

Caconeura nigra, sp. nov.

Two males from King Island, Mergui, Burma, 4th June 1921, collected by J. R. Elton Bott.

Male. Abdomen 28·5 mm. Hindwing 18 mm.

Head, prothorax, thorax, legs and abdomen entirely black save for some paired, tiny, white, basal, dorsal points on segments 3 to 6.

Wings hyaline : stigma black, braced ; postnodal nervures to forewing 15, 13 in the hind ; Cu_2 in the forewing 5 cells long, 4 in the hind ; *ab* vestigial, very small and enclosing a correspondingly small marginal cell.

Anal appendages of the usual generic shape but stouter and shorter than usual and the inferior spine of the superior appendages situated near the base ; black.

Habitat. As for *C. botti* which it much resembles except for the markings which are singularly lacking in this insect. The postnodal nervures are also fewer in number.

Type in the Pusa collection.

Caconeura autumnalis, sp. nov.

Four males from the western edge of the Ward Lake, Shillong, 13th October to 16th October 1919, collected by T. Bainbrigge Fletcher. Female unknown.

Male. Abdomen 26 mm. Hindwing 17 mm.

Head entirely black ; eyes pale brown capped with a darker zone of brown and an equatorial belt of the same colour which runs horizontally around the eyes.

Prothorax black, a little paler on the lower part of the sides.

Thorax black with two lateral, obscure, smoky brown stripes on each side and a spot of the same colour on the extreme posterior corner of the metepimeron.

Wings hyaline : stigma black ; postnodal nervures to the forewing 13 ; *ac* situated midway between the antenodal nervures ; *ab* incomplete and ending on the posterior border of the wing so as to enclose a marginal cell ; Cu_2 4 cells long in the forewing, 3 cells in the hind.

Abdomen black marked with pale brown and white as follows :— segment 1 with a pale brown, diffuse spot at the apical border below and an apical ring of white ; segment 2 has a dirty brown stripe low down on the side ; segments 3 to 7 have white, dorsal, basal lunules separated finely by the dorsal carina, and segments 3 to 6 have in addition pale, brownish, lateral, subapical, diffuse spots ; the remaining segments entirely black.

Anal appendages about the length of segment 10, of the usual generic type, black ; the apices of the inferior appendages creamy white.

Habitat. Concerning this species Mr. Bainbrigge Fletcher makes the note that it resembles *Pseudagrion rubriceps* in habits and that it hovers over the water.

Disparoneura campioni, sp. nov.

One male collected by T. Bainbrigge Fletcher at Margherita, 14th May 1920. One male from Kashgar (C. M. Inglis coll.)

Abdomen 31 mm. Hindwing 20 mm.

Head. Eyes bluish ; labrum pale blue, its base and the epistome with a broad transverse, black bar ; rest of head black except for the cheeks and a broad bar traversing the occiput which are sky blue.

Prothorax black with a lateral band of pale blue.

Thorax black on the dorsum marked with a narrow, blue, humeral stripe, blue on the sides marked with a black stripe on the second lateral suture. Legs pale, the femora stripde longitudinally with black on the extensor surface.

Wings hyaline ; the stigma black, covers one cell, its outer and posterior border somewhat rounded ; arc distal ,to the second antenodal nervure.

Seventeen postnodal nervures in one forewing, 15 in the other, 14 in both the hindwings. Cu_1 4 cells long in the forewing, 5 in the hind ; *ac* nearer the second antenodal ; *ab* complete ; Cu_2 absent.

Abdomen black marked with blue as follows : the sides of segment 1 ; a tadpole-shaped mark, the tail directed back on the dorsum of the second segment ; fine blue, basal annules to segments 3 to 7, and large, bright blue, recognition marks on the dorsum of segments 8 to 10 ; on segment 7 the blue covers less than the apical third, and on 9 it is encroached upon on either side at the base.

Anal appendages very similar to type but the inferior are rather more prolonged than usual and tapered ; their ends curl in and back and resemble two approximating hooks.

This insect bears a striking resemblance to *Indoneura gomphoides*, but its much smaller size will alone serve to disitnguish it and the blue markings separate it from all other Indian *Disparoneuras*.

Type in the Pusa collection.

Genus *Esme*, gen. nov.

Closely allied to genus *Disparoneura*, but considerably larger than any of the species belonging to that genus. Wings more densely reticulated and in this respect resembling *Indoneura*, from which it is separated by the nervure *ab* being complete instead of abbreviated and curving back to join the posterior margin of the wing. Cu_1 of much greater length than in *Disparoneura* and in the hindwing reaching nearly to the middle of the wing. Posterior lobe of prothorax of the female simple.

With the discovery of this genus it is possible to construct a probable line of descent of the Indian genera belonging to the Legion *Protoneura*.

Phylloneura (*P. westermanni*, Selys.)

Indoneura (*I. gomphoides*, Ramb.) — *Caconeura* (*C. dorsalis*, Selys.)

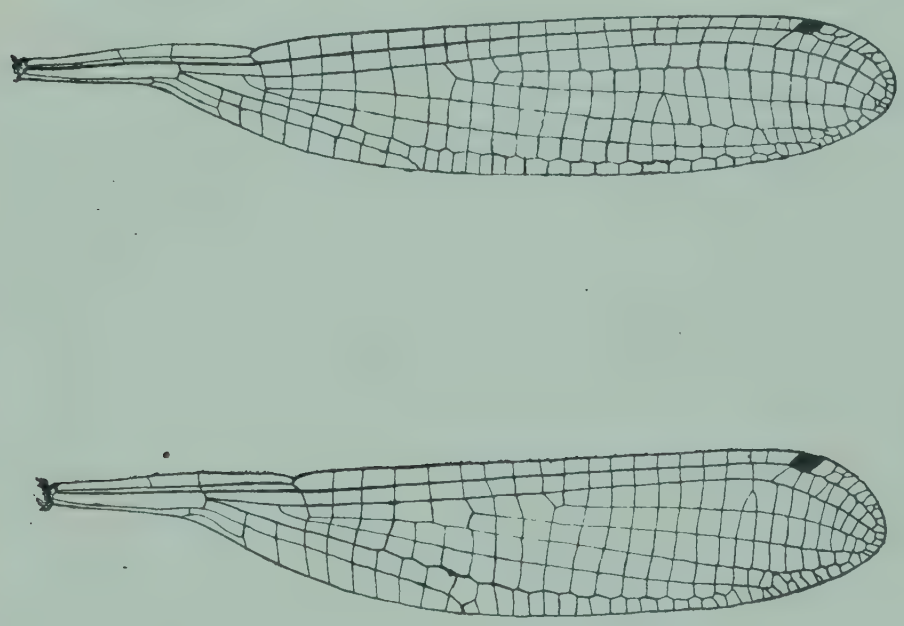
Esme (*E. cyaneo-vittata*, Fras.) — *Disparoneura* (*D. frenulata*, Selys.)

Phylloneura is undoubtedly the oldest of the five genera, the rudimentary intercalated sectors pointing to a very primitive type. *Indoneura* and *Esme* are both respectively more archaic than *Caconeura* and *Disparoneura* on account of their more dense reticulation and great length of Cu_1, whilst the formation of *ab* suggests a strong relationship between *Indoneura* and *Caconeura* and *Esme* and *Disparoneura* respectively.

Esme cyaneo-vittata, sp. nov.

Numerous specimens of both sexes, Kodaikanal, Palni Hills, collected by T. Bainbrigge Fletcher, during August 1921.

Male. Hindwing 30 mm. Abdomen 40 mm.
Female. Hindwing 31 mm. Abdomen 42 mm.
} Postnodal nervures forewing 21 to 22.



Wings of *Esme cyaneo-vittata*. (× 2½).

Both male and female are marked and coloured exactly as in *Indoneura gomphoides*, Rambur. In size they resemble *Indoneura ramburi*, Fraser.

Distinguished from the two latter species by the nervure *ab* being complete as in *Disparoneura.*

Subfamily Cœnagrioninæ.

Pseudagrion williamsoni, sp. nov.

Two males from King Island, Mergui, Burma, 4th June 1921, collected by J. R. Elton Bott.

Male. Abdomen 23 mm. Hindwing 18 mm.

Head. Eyes pale green or yellowish green with the extreme summit capped with dark brown ; labium a dirty white ; labrum citron yellow ; epistome and frons a greenish yellow ; rest of head blackish brown marked with a pair of very large triangular, postocular, turquoise blue spots and a short narrow line of greenish yellow bordering the occiput.

Prothorax. Anterior and posterior lobes turquoise blue, the middle lobe black, this colour enclosing a small lateral spot and a middorsal, geminate spot of blue.

Thorax black on the dorsum, deep sky-blue on the sides ; a pair of rather broad, pale greenish blue, humeral bands on the dorsum and two small, black points on either side.

Legs white, striped longitudinally with black.

Abdomen. Segments 1, 2, 3, 8, 9 and 10 deep sky-blue, the remainder pale greenish-blue, all marked with black as follows :—segment 1 has a basal quadrate spot with its apical margin slightly rounded and not reaching the apex of the segment and also a fine, subapical annule ; segment 2 has an oblong, rectangular spot on the dorsum, not reaching the base of the segment but connected with an apical annule by a short medial stem ; in its centre and nearer the base, this spot encloses a small, triangular spot of blue ; segments 3 to 7 have broad, longitudinal bands of black which expand subapically and then contract again before joining apical annules, except on segment 7 where the band gradually dilates as far as the apex ; segments 8, 9 and 10 are an intense violet blue, 8 and 9 having broad, black, apical annules, which cover not quite one-fourth of the dorsum of segment 8 and fully one-fourth of segment 9 ; segment 10 has a broad, black, dorsal mark extending from the base to the apex and narrowing towards the latter which is notched dorsally, and has a blue recognition mark lying between the two superior anal appendages.

Superior anal appendages truncate, strongly bifid at the apex, almost as long as segment 10, black. Inferior appendages very short, conical, white with a minute black point at the apex.

Wings hyaline ; stigma brown ; postnodal nervures to forewing 11, in the hind 9 to 10.

Female unknown.

Habitat. Swamp and running stream in three-year old rubber plantation. This species resembles *P. rubriceps* closely in its colouring and markings but has no red colouring on the head and the anal appendages differ widely. The dorsal marking on segment 2 closely copies that found on the same segment in the female of *P. rubriceps.* This marking and the black apical annules on segments 8 and 9 will serve to distinguish it from all other Indian species of the genus.

Type in the Pusa collection.

Pseudagrion spencei, sp. nov.

Several males and females from Pusa, Bihar, in March 1920, and Gauhati in September 1920, collected by T. Bainbrigge Fletcher.

Abdomen 24 mm. male, 25 mm. female. Hindwing 15 mm. male, 16·5 mm. female.

Male. Head. Labrum and epistome pale greenish blue, rest of head black save for large, pale blue, postocular spots.

Prothorax black on the dorsum, marked with a medial geminate spot of blue and a subdorsal, larger, similarly coloured spot. The sides pale blue. Thorax black on the dorsum, marked with narrow, blue, humeral stripes. The sides blue, the second lateral suture narrowly black.

Legs whitish, including tibiæ, the femora striped on the extensor surface with black.

Wings hyaline, the stigma black ; quadrilateral of hindwing distinctly broader than that of the fore ; 8 to 9 postnodal nervures in the forewing, 7 to 8 in the hind.

Abdomen blue marked broadly with black. The first segment with a small, quadrate, dorsal spot, the second with an elongated, thistle-shaped spot connected up with an apical, narrow annule ; third to seventh segments with broad, dorsal stripes which expand in the usual manner at the apex and then contract again before joining with the narrow apical ring ; this dorsal band is broader and not constricted apically on the seventh segment ; the eighth and ninth segments are all blue except for an apical row of black spines ; the tenth segment with a quadrate, black spot on the dorsum.

Anal appendages black, the inferior somewhat paler or whitish ; the superior bifid in profile at the apex, about as long as the tenth segment, without a basal, apical spine ; inferior very small.

Female. Head ochreous, unmarked, the postocular area olivaceous. Eyes brownish.

Prothorax ochreous with fine, transverse, irregular, black streaks across the middle and posterior border.

Thorax ochreous marked with three fine, parallel, black lines on the middorsum and a fine, humeral line of the same colour.

Legs pale yellow, the femora marked with black on the extensor surface.

Wings hyaline, the stigma yellowish. Ten postnodal nervures in the forewing, 8 in the hind.

Abdomen bright ochreous, almost reddish on the dorsum, marked with black as follows :—first segment touched with it dorsally at the extreme base, second segment with a fine, middorsal streak of black extending only for the basal three-fourths and ending with a short, transverse streak at either extremity—the whole shaped like an attenuated dumb-bell ; third to sixth segments with small, subapical, black, transverse spots, and very fine, apical, black annules ; seventh with a fine, middorsal, black streak connected with a transverse, short streak near the apex ; eighth with a broader streak, broadening apically ; ninth with a still broader streak tapering apically ; the tenth unspotted.

Anal appendages conical, ochreous.

Pseudagrion spencei is closely allied to *P. laidlawi*, but the ground colour of the male will serve easily to distinguish it and the meagre character of the black markings on the abdomen of the female form a marked contrast with the broad ones of *laidlawi*. These markings vary within limits in the female of *spencei*, but they are never more than a very fine, dorsal streak and, more often than not, this is absent on segments 3 to 6. The type specimen is a female from Shillong, 28th September 1920, collected by T. Bainbrigge Fletcher and which I had taken to be the female of *P. bidentatum*. The male is from Pusa, March 1920.

Pseudagrion laidlawi, sp. nov.

Six males and eight females from Karachi, Sind, 8th September 1919. (Type in my own collection.) Two males and two females from Nagpur, 18th December 1919, collected by T. Bainbrigge Fletcher.

Male. Abdomen 25 mm. Hindwing 16 mm.

Head. Eyes violaceous or bluish ; frons, epistome and labrum pale blue ; vertex pale lilaceous bordered in front by a narrow, black band at the level of the middle ocellus and edged outwardly, behind, by a black band.

Prothorax pale lilaceous, black on the dorsum where two wedge-shaped spots of the ground colour are enclosed.

Thorax lilaceous marked on the dorsum with three moderately broad, black stripes, one middorsal, the others humeral.

Abdomen pale blue with a violaceous tinting especially on the tenth segment ; the eighth and ninth segments are however a deeper sky-blue. Marked with black as follows :—first segment with an apical, narrow and a basal, broad spot ; second with a large, thistle-shaped spot on the dorsum, the stalk connected with a narrow apical ring ; third to seventh with broad, dorsal stripes widening apically ; eighth with a very small, basal spot and an apical row of black spines ; ninth with only a row of apical, black spines ; tenth with an X-shaped spot on the dorsum.

Legs pale blue, almost white. The extensor surfaces of femora striped with black.

Anal appendages blackish externally, whitish internally, hollowed out, bifid at the apex, the upper arm of the bifurcation being the longer. No basal spine as in the other members of the genus.

Female. Abdomen 25 mm. Hindwing 17 mm.

Head pale violaceous brown, unmarked ; eyes green.

Prothorax pale violaceous brown with no markings. Two small, dorsal spines on the posterior lobe, directed forward.

Thorax similar in colour and marked with three very fine black lines on the middorsum.

Abdomen. Ground-colour of the first two and the last three segments lilaceous, the other segments pale green, marked with black as follows :—first segment with a basal, black spot ; second with an attenuated, thistle-shaped spot on the dorsum ; broad, dorsal, black stripes on the dorsum of all the others except the tenth which is unspotted ; the apices of all segments bearing narrow, black annules.

Wings hyaline. Forewing with eight postnodal nervures.

P. laidlawi differs from all other Indian species of the genus by the peculiar ground-colouring, by the anal appendages not having a basal spine, by only having eight postnodal nervures instead of 10 and 11 as in *P. microcephalum*, and *P. bengalense*, respectively. The differences between it and *P. spencei* have already been mentioned above. It is very closely allied to the latter species.

Type in Major Fraser's collection.

[Also from Pusa, 30th October 1920, T. B. F.]

Indagrion, gen. nov.

Closely allied to *Mortonagrion* and less closely to *Agriocnemis*. Prothorax of female simple. Arc well distal to the second antenodal nervure ; *ab* present and meeting *ac* which lies about midway between the two antenodals ; *ab* is continued outward in the same straight line as Cu_2 and not meeting at an angle ; quadrilateral of forewing much stouter and shorter than that of the hind, both acutely pointed.

Female without a ventral spine.

The chief difference between *Mortonagrion* and *Indagrion* is that in the former there are three cells between the quadrilateral and the level of the subnode, whereas in the latter there are only two.

Genotype : *Indagrion gautama*, Fraser.

Indagrion gautama, sp. nov.

A single female from Sadiya, 23rd May 1920, collected by T. Bainbrigge Fletcher.

Abdomen 24·5 mm. Hindwing 16·5 mm.

Head black above, the labrum with a basal greenish blue stripe. A large pale blue postocular spot on either side of the occiput.

Prothorax black above, pale blue at the sides.

Thorax greenish blue with the dorsum broadly black and a broad, humeral and a very narrow, lateral stripe of the same colour. The black appears to enclose a greenish-blue humeral stripe.

Wings hyaline ; 9 postnodals in the forewing, 7 in the hind. Stigma rather elongated, blackish.

Abdomen greenish-blue, marked with black as follows :—first segment with a broad, subtriangular patch on the dorsum, not reaching the apex of the segment ; second segment with a thistle-shaped mark on the dorsum, connected with an apical ring of black ; segments 3 to 7 all with a broad, dorsal stripe which first widens and then contracts again to join the apical black ring ; segments 8 to 10 all black, except for a small, blue annule between 8 and 9.

Legs black, tibiæ paler and possibly pale blue in life.

There is no ventral spine on the eighth segment, which serves to separate the insect from *Ischnura* and *Enallagma*.

Type in the Pusa collection.

Aciagrion azureum, sp. nov.

Abdomen 30 mm. Hindwing 20 mm.

A single male from Margherita, Assam, 18th May 1920, collected by T. Bainbrigge Fletcher. Very similar to *Aciagrion olympicum*, Laid., but differs in the colouring of the head and the venation of the wings.

Head. Labrum pale yellowish ; epistome traversed by a transverse, black band ; face and cheeks pale yellow, rest of head black except for very large, blue, postocular spots. (In *olympicum* the postocular marking is a transverse streak meeting across the occiput.)

Prothorax black on the dorsum, pale blue on the sides.

Thorax black on the dorsum, marked with fine, blue, humeral stripes. Sides blue, changing to creamy yellow low down on the sides.

Wings hyaline, stigma brownish. Postnodal nervures 11 and 10 respectively in the right and left forewings, 9 in the hind. (These number 13 in the forewing, and 11 in the hind in the wings of *A. olympicum*.)

Abdomen with the ground-colour of the first two segments and the last three blue. Segment 1 has a large, quadrate, black spot on the dorsum not reaching the apex of the segment, 2 has a broad, thistle-shaped mark on the dorsum, and segments 3 to 7 broad, dorsal, black stripes which enlarge abruptly at the apical end and then contract again to meet fine, black, apical rings ; on segment 7 the stripe is broader and tapers gradually from the apex to base ; segments 8 to 10 are unmarked.

Anal appendages are small and very similar to those of *A. olympicum* ; the superior are, however, more conical and not bifid as seen in profile ; black in colour.

Type in the Pusa collection.

Enallagma parvum, Selys.

Female. Abdomen 17 mm. Hindwing 12 mm.

The female described below was taken by myself at Parel Tank, Bombay, March 1917. (This specimen was being devoured by a male *Crocothemis servilia*.) Other specimens from Poona, September-October 1918. Mr. Bainbrigge Fletcher has taken specimens at Nagpur, 18th December 1919, and at Pusa, 30th December 1919. I have had a single specimen sent to me from Simla which differs from the others by not possessing humeral bands, and have seen two other similar specimens recently. It is therefore a dimorphic insect.

Very similar to the male but stouter in build. Markings similar but broader, especially on the abdomen where the dorsum is entirely black except on the tenth segment which is usually unmarked.

Ground-colour pale blue or bluish green, the dorsal surface suffused with yellow. Thorax usually pale yellow deepening dorsally between the black markings. The postocular spots connected by a fine yellow band.

In the Simla specimen, the head, posterior to the black band traversing the vertex, is entirely pale blue or blue edged posteriorly with yellow and there are no black humeral bands. The labrum is unmarked in this specimen but in the other specimens it bears a black spot.

The eighth abdominal segment bears a ventral spine.

Females of *E. parvum* are rarely seen, even where the male is in great numbers, and those taken are almost invariably *in cop.* Apparently they only emerge from their hiding places when pairing.

Agriocnemis d'abreui, Fraser. (Plate VI, fig. 1.)

Rec. Ind. Mus., XVI, p. 454 (1919).

Several males and females from Gauhati, Assam, 14th November 1919, and from Tokhlai, Jorhat District, Assam, 23rd November 1919, collected by T. Bainbrigge Fletcher.

The female was described from a solitary specimen taken by Mr. E. A. d'Abreu at Lamta, Balaghat District, Central Provinces, 23rd March 1919. The male has not yet been described.

Male. Head : labrum blue with a black streak traversing it, which encloses two minute spots of the ground-colour, a narrow black streak at the base of the frons which is a pale blue ; eyes black in the upper third, blue in the middle, fading to pale green below. The rest of the head black except for small, blue, postocular spots connected across the middle line by a fine yellow band.

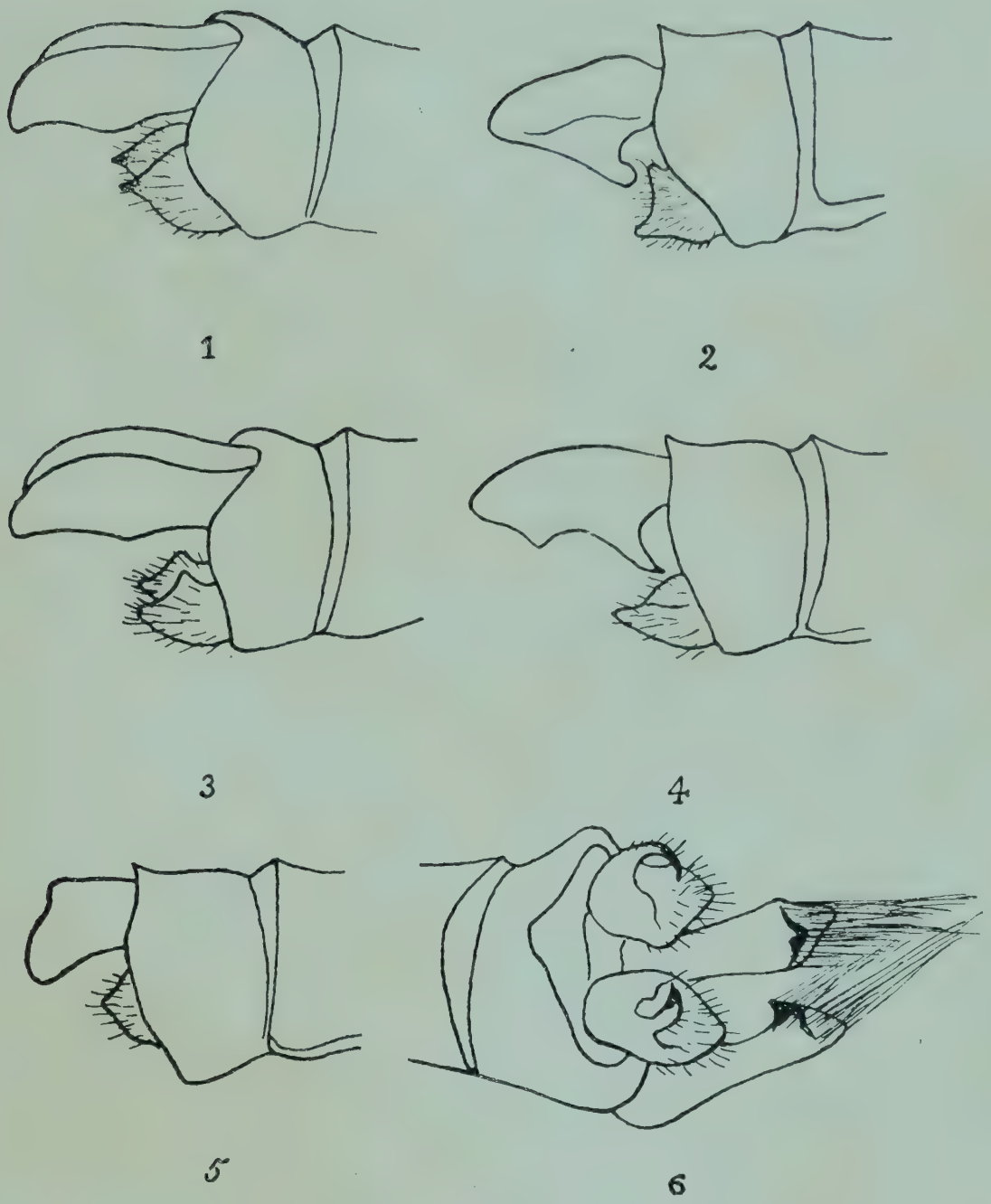
Prothorax black above, blue at the sides and narrowly along the free border of the posterior lobe which is rather prolonged.

Thorax black on the dorsum, traversed by a fine, blue, humeral line on either side, the lateral blue fading to pale yellow below.

Legs white marked with black streaks on either side.

Wings : 5 to 6 postnodals in the forewing. Stigma pale brown.

Abdomen blue with a greenish tinge and changing to yellow or bright ochreous on the last four segments ; marked with black as follows :—the whole of the dorsum of the first segment ; a large mark



1 2

3 4

5 6

ANAL APPENDAGES OF SPECIES OF *AGRIOCNEMIS*.

1.	Anal appendages of	*A. d'abreui,*	lateral view,	Original.
2.	,, ,, ,,	*A. nana,*	,, ,,	After Laidlaw.
3.	,, ,, ,,	*A. splendidissima,*	,,	Original.
4.	,, ,, ,,	*A, clauseni,*	,, ,,	,,
5.	,, ,, ,,	*A. pygmæa,*	,, ,,	,,
6.	,, ,, ,,	*A. incisa,*	seen from below,	,,

on the dorsum of the second segment, contracted in two stages posteriorly and with two blue enclosures in the fore part (this marking strongly reminds one of the pair-of-spectacles marking on the hood of a cobra) ; a black streak on all of segments 3 to 6, incomplete basally, expanding apically and then contracting again just before the extreme apex, where it joins an apical, black annule ; the seventh to tenth segments bear more or less obscure, browny black markings made up of a central stem and lateral branches which arise apically and run for a short distance forward.

Anal appendages very long and narrow (Plate VI, fig. 1). The superior longer than the tenth segment, elongated, parallel-sided, slightly curved in a downward direction and with a blunt apex, ochreous marked with black externally and apically. The inferior very small, foliate, cordate, pale green, with a small, shiny black point at the apex. There is no accessory armature to the superior appendages as in *A. nana* and *A. clauseni* (Plate VI, figs. 2 and 4). They resemble the appendages of *A. splendidissima* Laid., to which the insect is closely allied Plate VI, fig. 3).

Length of hindwing 9 to 9·5 mm., of the abdomen 13 to 14 mm.

A study of the new material reveals the fact that there is considerable variation in the colouring of the females which appears to be dependent on the age of the specimens.

The colour of the thorax is more often black than blue and there is a narrow, creamy, humeral line on either side which may be well defined or partly or entirely obsolete. The sides are blue or greenish blue but the black may extend down so low as almost to obscure this colour, especially in very adult specimens.

On the abdomen the black markings are extremely variable. In the young specimens the lateral markings are entirely wanting In the very adult, these markings are so extensive that they largely blot out the ground-colouring of the first three and the last three and the greater part of the seventh segments, leaving only small traces of blue.

Postnodal nervures vary in the female from 6 to 8, and the length of the hindwing from 10 to 12 mm. Length of abdomen 15 to 16 mm.

Habitat. Found in similar situations to those of *A. pygmæa.*

Agriocnemis clauseni, sp. nov. (Plate VI, fig. 4.)

A number of males and females from Shillong, Assam, collected by T Bainbrigge Fletcher, during the middle months of 1918, and from August to October 1919. [Also from Margherita and Gauhati.—T. B. F.

I had referred this species to *Agriocnemis nana*, Laid., to which the insect bears a close resemblance. Dr. Laidlaw gives the measurements of his species as hindwing 9 mm., abdomen 18 mm. This ratio is very unusual and excessive so that a printer's error may have crept in. Apart however from the size, *A. nana* has only 6 postnodals in the forewing, whereas *A. clauseni* has 9.

The colouring is the same in the two species and the markings are almost identical, differing as follows :—

Head : the labrum is black, the frons blue. The postocular space bears a large, blue, comma-shaped mark enclosed in the black and is not entirely blue as in *A. nana*. (In a very young specimen, the space would probably be entirely blue.)

The prothorax has a narrow blue collar anteriorly and there is a small, boomerang-shaped spot, blue, low down on each side.

The thoracic humeral stripes tend to taper from before backwards. The lower edge of the black has one or two marked dentations and there is an additional patch of black just posterior to the hind coxæ. The under surface is black.

The abdominal markings differ only in the terminal segments : on the seventh the black marking expands on the basal third, then narrows abruptly to a thin middorsal line and finally expands again to cover the whole of the apical fourth ; the eighth to tenth segments are entirely black, the ninth not having the lateral blue spot ; segments 3 to 6 have sublateral bands which meet apically with the dorsal band to enclose a small blue spot.

The anal appendages agree closely with the figure and description given by Dr. Laidlaw (Plate VI, fig. 4). The colour is the same but the ventral spur on the superior organs is sharply acute and strongly curved.

The female of *A. nana* is unknown ; the following is a description of that of *A. clauseni*.

Exactly similar to the male except for the abdominal markings which differ as follows :—the first two segments have a small, black, lateral spot on each side ; the dorsal marking on the second segment is much broader and the two spots of enclosed blue, seen in the male, are absent ; the third to sixth segments have only broad, dorsal bands and there is no enclosed blue spot at the apex ; the dorsal band on the seventh segment is of even width throughout.

A. splendidissima, Laid., *A. nana*, Laid., *A. d'abreui*, and *A. clauseni* bear very similar facies and form a very natural group. In all, the superior anal appendages are of comparatively great length and much longer than the

inferior. The three latter species all bear the highly characteristic and specialized marking on the dorsum of the second abdominal segment and there is a suggestion of it even in the first-named. The anal appendages of *A. splendidissima* and *A. d'abreui* are almost identical and the same comparison applies to the other two species.

Type (male) of *A. clauseni* in the Pusa collection.

Subfamily Platycneminæ.

Melanoneura, gen. nov.

This genus belongs to Selys' "Legion IV," as restricted by Laidlaw.

Ab is absent ; Cu_1 extends for only 7 cells in the hindwing ; Cu_2 is absent ; supplementary basal postcostal nervure absent ; stigma rhomboidal. Prothorax simple. Legs with long cilia.

Genotype : *Melanoneura bilineata*, Fraser.

Melanoneura bilineata, sp. nov.

A single specimen, male, with the last four abdominal segments missing, collected by Rao Sahib Y. Ramachandra Rao, at Sidapur, Coorg, 25th April 1917.

Abdomen 23 mm. (this measurement does not include the last four segments). Hindwing 23 mm.

Head. Labrum metallic blue, cheeks pale blue, rest of head black.

Prothorax black on the dorsum, pale yellow at the sides.

Thorax broadly black on the dorsum, marked with humeral, blue stripes which are incomplete below and above, not reaching the alar sinus. Sides pale yellow marked with a fine, black line on the second lateral suture.

Wings hyaline ; stigma black ; postnodals in forewings numbering 20, in the hind 18.

Abdomen pale yellow ; the first segment unmarked ; all others marked on the dorsum with a broad, black band, darkest at the apex and diffusing towards the base where are found fine, basal annules. The last four segments are unfortunately missing so that the shape of the anal appendages is uncertain.

Legs very characteristic ; reddish orange marked with three broad, black annules, one at the distal end, one at the middle and the other near the base.

Venational characters separate this insect from *Cœliccia*, which it resembles superficially and for which I at first mistook it.

Type in the Pusa collection.

Pseudocopera, gen. nov.

Antennæ as for *Copera*; prothorax of female with a trilobed posterior lobe, the two lateral lobes very much smaller than the central division.

Abdomen very long and very slender; appendages highly specialized.

Sectors of arc fused, the arc distal to the second antenodal nervure; stigma nearly as broad as long. Petiolation begins proximal to *ac*; *ab* present; Cu_2 extending far beyond the middle of wing. Posterior and middle pairs of tibiæ greatly dilated and with very long cilia.

Differs from *Copera* by the shape of the prothorax of the female, by the shape of the stigma and by the length of Cu_2. Other features are the relatively large size of the insect and the shape of the anal appendages, which are more like those of a *Cyclogomphus* or *Onychogomphus* than *Copera*.

Genotype: *Pseudocopera arachnoides*, Fraser.

Pseudocopera arachnoides, sp. nov. (Plate VII, fig. 4.)

Two males and three females from Margherita, collected by T. Bainbrigge Fletcher, 14th to 19th May 1920.

Male. Head: labrum and cheeks yellowish, the former narrowly bordered with black at the base. Rest of head black except for an oval, yellow spot bordering the eye posteriorly and a small, similar coloured spot on the rear of the occiput. Eyes brown. First segment of antenna and the tip of the second segment pale yellow.

Prothorax black, marked with a longitudinal, yellow stripe on the subdorsum.

Thorax black, the sides yellow, the second lateral suture finely black; a narrow, yellow, humeral stripe on each side.

Legs very long and spidery, white. The distal ends of the femora, the extensor surfaces of the anterior tibiæ, the tarsi and the spines black. The four posterior tibiæ are widely dilated and serve the purpose of recognition marks very much the same as in numerous species of *Rhinocypha*.

Abdomen black, the sides of segments 1 and 2 with narrow, basal annules interrupted narrowly on the dorsal carina, and the basal three-fourths of segment 9 and the whole of segment 10 yellow. Beneath pale brown.

Anal appendages yellow, a spine on the superior and the apical half of the inferior black. Superior conical, nearly as long as segment 10 with a basal, inferior, black tooth. Inferior much stouter, nearly twice the length of the superior, curving strongly downward, tapering gradually and with the ends slightly approximated. The superior are directed strongly upward so that, seen in profile, the appendages are markedly divaricate.

Wings hyaline ; stigma yellowish brown, the centre darker and the bordering nervure dark brown. Postnodal nervures to forewing 15, 12 to 13 in the hind. M_{1a} 6 cells from the stigma in the forewing, M_1 10 cells.

Length of abdomen 40 mm., of hindwing 24 mm.

Female very similar to the male but differing as follows :—abdomen 38 mm., hindwing 24 mm. A black spot on the labrum and a black, transverse streak on the epistome. The legs entirely reddish yellow, except the tarsi which are brownish. Only the apical border of segment 9 and the whole of segment 10 yellow. The sides of segments 1 and 2 and the interrupted basal annules are yellow as in the males. Segment 10 is raised dorsally into a prominent ridge, much the same as in *Ischnura*. Anal appendages conical, yellow.

Wings with 14 to 16 postnodal nervures in the fore, 13 in the hind.

Type (male) and co-type (female) in the Pusa collection.

Subfamily. Lestinæ.

Indolestes, gen. nov.

Wings closed over dorsum during repose ; petiolated as far as the post-costal nervure (*ac*) ; M_2 arising $3\frac{1}{2}$ cells from the node in the forewing, $2\frac{1}{2}$ in the hindwing (5 in both wings of *Indolestes gautama*) ; *Ms* slightly angulated ; M_4 undulated at the level of the node ; stigma three times as long as broad, its outer border not oblique, over 2 to 3 cells ; quadrangle about one-third longer in the hindwing than in the forewing ; inner side of quadrangle of forewing only one-third the length of the posterior side, that of hindwing only one-sixth the length ; posterior lobe of prothorax rounded, simple, not lobed.

In this genus I include a species described by Dr. Laidlaw (*Lestes* sp., Laid. *Rec. Ind. Mus.*, Vol. XIX, p. 161 ; 1920), *Indolestes indica*, and *Indolestes helena*. All bear a close resemblance to *Sympycna* but may be distinguished by the simple lobe of the prothorax and by the outer margin of the stigma not being oblique. Lastly, *Lestes bilineata*, Selys, must be considered as belonging to this compact little group, even though the male is as yet unknown.

Genotype : *Indolestes indica*, Fraser.

Key to the genus Indolestes.

1. Abdomen only 24 mm. in length ; dorsal bands on the second abdominal segment, broadest at the base and coalescent except at the apex .. .. *Indolestes buddha*, Laidl.
   Abdomen 30 mm. in length 2

2. Dorsal bands on the second abdominal segment incomplete at the middle of segment, the basal parts coalesced, the apical as two subtriangular spots which may or may not be confluent .. .. *Indolestes indica*, n. sp.
   Dorsal bands complete 3

3. Dorsal bands on the second abdominal segment coalescent only for a short space at the apex where they enclose a small, oval spot of the ground-colour.. *Indolestes helena*, n. sp.
   Dorsal bands on the second abdominal segment coalescent only at a point near the base or separated throughout .. .. .. *Indolestes bilineata*, Selys.

Indolestes indica, sp. nov.

Several males and females collected at and around Shillong by Mr. T. Bainbrigge Fletcher, 19th June 1920, 18th to 27th October 1919. ("Taken on bushes by side of stream." "A pair taken on a hill-top quite away from water." "All resting with wings folded over the back.")

Abdomen, male 30 mm., female 28·5 mm. Hindwing, male 19 mm., female 21 mm.

Male. Head pale brown, vertex, occiput and back of eyes black with a coppery reflection. A small, pale spot just behind and external to each lateral ocellus. The apical half of basal joint of antennæ and the basal half or three-fourths of the second joint pale brown, almost white.

Eyes bluish grey, striped from above down with five parallel, dark brown bars.

Prothorax pale brown at the sides, broadly black on the dorsum; posterior lobe rounded and of moderate size.

Thorax pale fawn, the dorsum matt black with a coppery reflection not amounting to metallic. The dorsal marking has two lateral prolongations, one above at the alar sinus and one about the middle of the dorsum, the former extending outwards to the humeral sinus and often overflowing it, but the latter stopping short of it. Posterior to the humeral sinus three small, elongate, brown spots which are occasionally metallic. Elongate black spots at the upper part of the first and second lateral sutures. The sides of the thorax are paler at the humeral suture and beneath and there are two diffuse, blackish brown markings beneath the metepimeron.

Legs black on the flexor surfaces, pale brown on the extensor.

Wings pale brown, uniformly enfumed. The stigma dark brown, bordered with blackish nervures except outwardly where it is edged with white or very pale brown and there is also a small white point at the inner, posterior angle. Postnodal nervures 12-13 in the forewing, 11-12 in the hind; quadrangle of hindwing rather more than one-third longer than that of the fore.

Abdomen pale brown, the markings subject to some variation owing to the variable size of the spots; first segment with a basal, black spot and a

medial, subcostal, small spot on each side ; second segment with a cordate spot at the base which may, however, be tapered apically at the middorsum and is then shaped like a wineglass with the base missing ; apically two subtriangular, subdorsal, black spots which may or may not meet across the middorsal line ; the basal spots are metallic green, the apical matt black and the dorsal carina between them is finely yellow ; third segment with a pair of pyriform, green metallic, basal spots and a pair of black, subtriangular spots which usually meet across the middle line ; these spots are repeated on the fourth to sixth segments but the spots diminish progressively from before posteriorly and on the fifth and sixth they are non-metallic ; seventh and eighth segments with long, black, broad, diffuse stripes tapering basally ; ninth segment with a pair of basal, triangular, subdorsal spots ; the tenth segment immaculate.

Anal appendages almost white, tipped with black. The superior directed posteriorly almost straight for rather more than the basal half and then curving inward until they meet, at which point they are again directed basalwards ; the two ends are in apposition and, viewed from above, they resemble the arms of a man about to dive ; viewed in profile, the ends of the appendages are tumid and turned down at an oblique angle, just anterior to which there is a stout, ventral spine, directed inwards ; externally the border presents some fine denticulations and the ends are tufted with hairs. Inferior appendages about half the length of the superior, broad at the base, tapering and divergent apically where they are tufted with longish hairs.

Female. Exactly similar to the male except that the stigma is paler, the node is somewhat thickened and the wings are more deeply enfumed. The marking on the second segment is broader and the apical and the basal spots are joined together, enclosing a small, oval, pale brown spot or longish streak at the apical end. Segments 6 to 9 are largely brownish-black on the dorsum and the sides. The posterior lobe of the prothorax is simple and rounded. The lower part of the sides and beneath of thorax are pruinescent white.

Dr. Laidlaw's *Lestes* sp., mentioned above, and which I have named *Indolestes buddha*, bears a strong superficial resemblance to the present insect. It differs as follows :—the size is smaller, abdomen of female only 23·5 mm., and hindwing only 19 mm., the small, dorsal spots on the head are absent ; the prothorax is entirely differently marked ; segment 1 has a square, dorsal spot, without a basal spot, and additional subdorsal spots. The markings on the dorsum of the second segment are very similar to those of *Indolestes indica*.

Type (male) and co-type (female) of *I. indica* in the Pusa collection.

Indolestes helena, sp. nov. (Plate VII, fig. 1.)

Four females and three males from Kurseong, 17th—27th Septembe 1920, collected by C. M. Inglis.

Male. (All the specimens are a little teneral and markings indefinite.)

Abdomen 32 mm. Hindwing 21 mm.

Head dark brown, unmarked, with a coppery reflection; labrum paler. Prothorax dark brown, the middorsum a little paler. The posterior lobe broadly rounded, simple.

Thorax broadly dark brown on the dorsum with a coppery reflection. The sides pale yellow marked with a moderately broad, dark brown stripe on the first lateral suture. Legs dark brown, the extensor surfaces pale yellow.

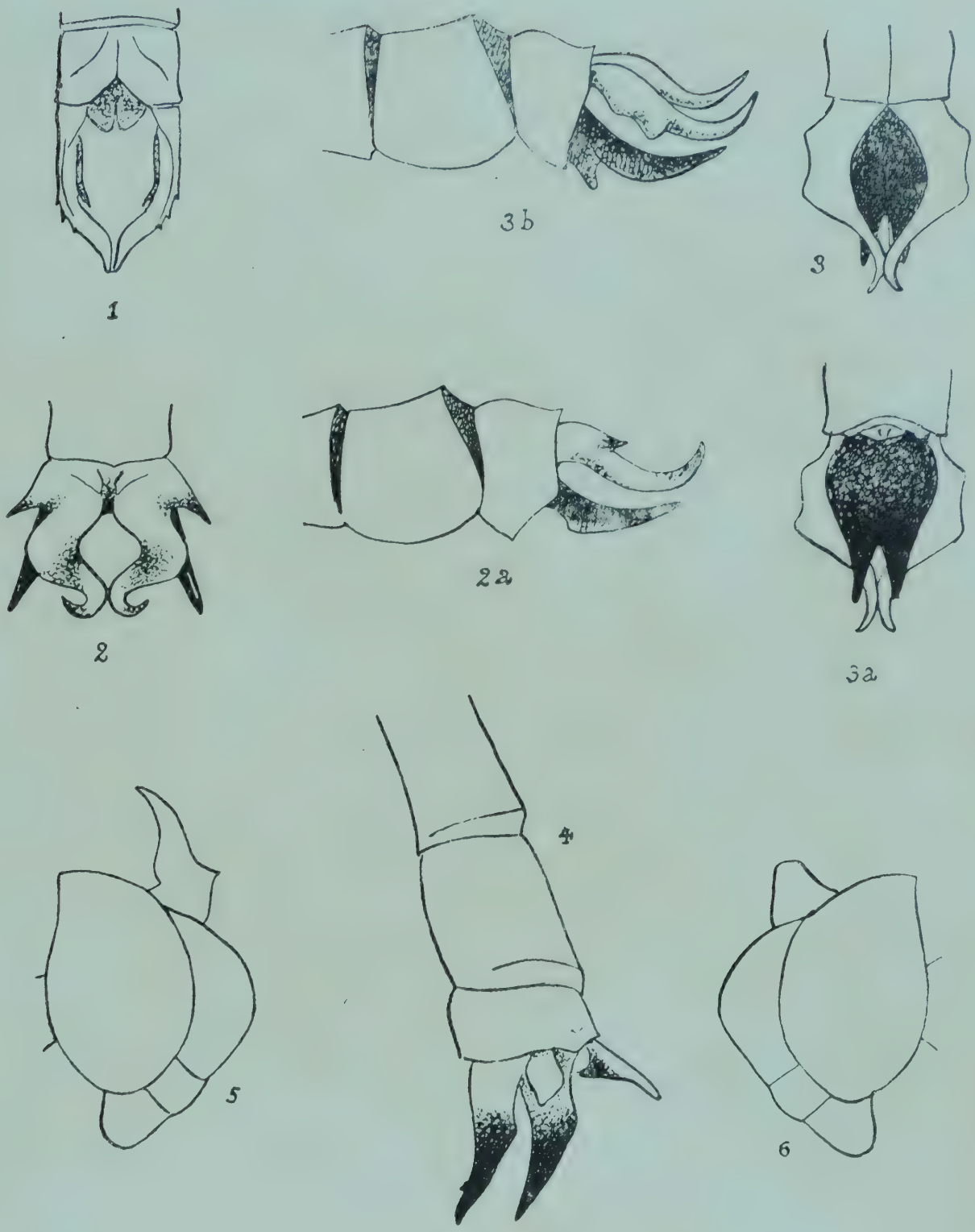
Abdomen pale brown marked with dark brown; first segment with a basal marking and an apical ring; second segment with two subdorsal stripes, narrow basally but broadening abruptly at the apical third where the two stripes enclose an oval spot of paler brown; segments 3 to 6 with subdorsal, wedge-shaped spots, which meet over the dorsum at the apex and gradually taper away diffusely at about the middle of these segments, and increase in size as traced towards the apex of the abdomen; segments 7 to 9 have the dorsum entirely dark brown, whilst 10 is unmarked and almost white in colour; the tenth segment deeply but narrowly notched in the centre. All markings are somewhat coppery and that on the second segment gives promise of becoming green metallic.

Anal appendages pale yellow. The superior as long as segment 9, straight in the basal half, then curving abruptly inward to meet each other, the apices being directed somewhat straight basalwards again for a very short distance; externally there are three or four small teeth and internally there is a fine, sharp, black spine directed back and a little downwards. The inferior are triangular, in close apposition and less than one quarter the length of the superior.

Wings very faintly enfumed with brown, the nervures brown. Very long and narrow, the apices rapidly narrowing after the stigma. The latter brown with a pale margin of yellow on the posterior and inner and outer borders. The outer margin not oblique, about three times as long as broad.

Female differing in the slightest degree from the male. The abdominal markings rather broader.

This species is distinguished from *Lestes bilineata*, Selys, by its long stigma, three times as long as broad (only twice as long as broad in



1, Anal appendages of *Indolestes helena*, male ; 2, Anal appendages of *Leptogomphus spirillus* seen from above, male ; 2a, The same viewed from the side ; 3, Anal appendages of *Stylogomphus inglisi* seen from above, male ; 3a, The same seen from below ; 3b, The same viewed from the side ; 4, Anal appendages of *Pseudocopera arachnoides*, male ; 5, Head of *Idionyx corona*, female ; 6, Head of *Idionyx ornata*, female.

bilineata), from *indica* also by the character of the stigma and also by the markings on the dorsum of the second abdominal segment. From *Indolestes buddha* it is distinguished by the much shorter length of the abdomen and also by the markings on the second abdominal segment.

Type (male) and co-type (female) in the Pusa collection.

FAMILY AGRIONIDÆ.

Subfamily Libellaginæ.

Rhinocypha beesoni, sp. nov.

Several males and females from Lachiwala, Dehra Dun District, collected by C. F. C. Beeson, 18th November 1920, and two pairs from King Island, Mergui, Burma, collected by J. R. Elton Bott, 4th June 1921.

Male. Abdomen 18 mm. Hindwing 25 mm. Greatest breadth of hindwing at its outer third, 5 mm.

Head black marked with five yellow spots, one on either side of the ocelli, reniform in shape and with the hilus facing inwards, and a row of three small, round spots on the occiput, one central and the others lateral.

Prothorax black with a violet spot low down on the side and the whole of the posterior lobe a beautiful cerise colour.

Thorax matt black, the carinal triangle, which extends for only about one-third upwards, and the carina itself cerise. On either side of the triangle, and considerably larger than it, is a posthumeral spot of pale purple, its inner margin straight and limited by the humeral suture, its outer strongly convex. At the apex of this spot is a small circular spot of the same colour and bordering on the anterior border of the first lateral suture is a narrow line of blue. Between the two lateral sutures is a very irregular stripe of pale blue and two isolated spots of the same colour, one of which is about the middle of the thorax, anterior to the stripe, and the other high up near the base of the hindwing. Finally, the anterior two-thirds of the metepimeron pale blue. Beneath the thorax is black marked with seven large spots of chrome yellow.

Legs black, the anterior coxæ and the mid femora yellow on the flexor surface. The hind tibiæ, which are a little expanded, are chalky white on the flexor surface.

Wings long and very narrow, the hind not markedly more so than the fore, hyaline, but slightly enfumed ; stigma black in all wings ; forewing with the apex as far as 2 to 3 cells proximal to the stigma dark brown, the inner margin of this dark area a little irregular, bevelled slightly outwards posteriorly and prolonged along the costa, as far as halfway between the stigma

and the node between the costa and radius. Posteriorly there is also a slight prolongation along the margin of the wing. Hindwing with the apex also, but much more broadly than the forewing, dark brown, this colour covering about the outer third of the wing, its inner margin convex and curving strongly basalwards posteriorly, its anterior margin prolonged inwards as in the forewing, marked with a single row of longitudinal, vitreous spots, the anterior three of which are only one cell deep, the fourth 3 cells deep and the fifth or posterior spot merely a single cell. In addition to these spots in the dark area, there is a row of three vitreous, longitudinal spots in the hyaline area, the posterior two of which are contiguous with the dark area and the anterior one separated from it by one or two clear cells. There is also another vitreous streak of 9 cells length situated about the middle of the wing with its inner end at the level of the node. In the dark area the vitreous spots are metallic green or coppery according to the angle from which viewed, in the hyaline area they are violet. Antenodal nervures to the forewing 14-15, postnodals 22-25. Only a single row of cells between Cu_2 and the posterior margin of the wing. Quadrilateral traversed 3 times in the forewing, 4 times in the hind.

Abdomen matt black marked with pale blue as follows :—the first segment with a large, subtriangular, lateral spot ; segments 2 to 5 with 2 parallel, longitudinal, lateral lines neither extending to the base or apex of the segment ; at the apical end of the superior line there is an isolated, rounded spot ; segments 6 to 9 have only the inferior line present but diminishing in length as traced apicalwards until it is finally absent on the tenth segment.

Anal appendages black, the superior rather longer than the tenth segment, the inferior shorter, very similar in shape to those of *R. bisignata.*

Female. Abdomen 16 mm. Hindwing 25 mm.

Closely similar to the female of *R. bisignata* from which it can scarcely be distinguished.

Head, in addition to the markings already noted for the male, marked as follows :—two spots at the base of the labrum, two just behind the epistome, the lateral lobes of the labrum, the basal joints of the antennæ, and a streak along the inner border of the eyes, chrome yellow.

Prothorax black with a lateral spot of yellow and a median line of the same colour incomplete on the middle lobe.

Thorax black, the carinal triangle, which is of the same size as in the male, outlined in yellow. A fine humeral line of the same colour incomplete on the upper half of the dorsum and curling out below to form a hook-like marking. The sides marked as in the male but yellow and the whole of the metepimeron of this colour except for a lower marginal streak of black.

1, *Rhinocypha quadrimaculata quadrimaculata*; 2, *R. bifenestrata*; 3, *R whiteheadi*; 4, *R. perforata perforata*; 5, *R. quadrimaculata hemihyalina.*

Legs black, the coxæ and posterior surfaces of the femora yellow.

Wings hyaline, more deeply enfumed than in the male but no dark areas or vitreous spots. Stigma dark brownish, paler in the middle.

Abdomen black marked with yellow, the markings being otherwise as in the male.

This species is interesting as having reached me from two rather widely separated areas within a week of each other. The two sets of insects show no differentiation whatever but the Burmese type is remarkable as being the first Indian species to be reported from sea-level or thereabouts. *R. beesoni* which has been named after Mr. C. F. C. Beeson, Forest Zoologist, Dehra Dun, its first discoverer, is very closely allied to *R. bisignata* and is apparently the northern representative of this latter insect ; indeed, it is very probable that *R. bisignata* is a direct lineal descendant of it.

Rhinocypha bifenestrata, sp. nov. (Plate VIII, fig. 2.)

Two males from Mangpu, Darjiling District, 3,860 feet, 30th August and 3rd September 1920.

Abdomen 25 mm. Hindwing 27 mm.

Very like *R. trifasciata*, but differs in the wing markings.

Body, including the head, black without any markings save on the thorax. The latter with a long, mesothoracic triangle extending right up to the alar sinus and pale lilaceous in colour. Laterally there is an anterior yellow spot followed by a longitudinal stripe of the same colour.

Wings differ markedly from true *trifasciata*. The forewings have a dark, blackish brown fascia extending from the apex to a little proximal of the node and about one-third the breadth of the wing in depth. The posterior margin is jagged and the fascia widens rapidly and obliquely from the inner margin of the stigma.

The hindwings have an apical fascia extending inwards from about the middle of the stigma, a medial fascia situated about midway between the node and the stigma, and a basal, opposite the node, the basal margin of which is a little sinuous and the outer margin prolonged in a long, irregular manner at its middle towards the medial fascia. All three fasciæ are narrowly connected up along the costa and termen so that two large fenestra are enclosed, the outer regular, the inner very irregular. The iridescence of the wings is similar to that of *trifasciata*.

Type in the Pusa collection.

This species was collected by Mr. C. M. Inglis along a very heavily wooded hill-stream.

Rhinocypha quadrimaculata hemihyalina, sub-sp. nov. (Plate VIII, fig. 5.)

A single pair from Shillong, 16th October 1919, collected by T. Bainbrigge Fletcher.

Very similar to *Rhinocypha quadrimaculata quadrimaculata* (Plate VIII, fig. 1) but differs by the fascia on the forewing being much narrower.

Male. Head velvety black, marked with a minute, postocular yellow spot on either side of the occiput.

Prothorax and abdomen black, unmarked (or the markings may have faded).

Thorax black, with lateral, yellow markings and a mesothoracic triangle, pale lilaceous, extending as far as the alar sinus. Posterior femora white.

Wings similar to those of true *quadrimaculata* but the fascia on the forewings only covers the fore half instead of four-fifths.

Female. Head black, marked with yellow as follows :—small spots on either side of the ocelli, a streak on either side of the epistome, a spot at the same level adjacent to the eye and a spot on either side of the occiput.

Prothorax black with a fine middorsal yellow streak.

Thorax with the mesothoracic triangle long and narrow, lined out in yellow, a fine, parallel line of yellow, antehumeral in position, a fine posthumeral streak of the same colour incomplete below, and finally a broad, lateral, longitudinal yellow streak on the side of the thorax traversing the posterior part of the mesepimeron and the metepimeron.

Abdomen black with the middorsal carina finely yellow and a streak followed by a small spot, on the sides of the second to eighth segments.

Legs black.

Wings tinted with yellow at the base. Stigma black but yellow in the middle.

Abdomen, male 23 mm., female 21 mm. Hindwing, male 23 mm., female 28 mm.

Type (male) and co-type (female) in the Pusa collection.

SUB-ORDER ANISOPTERA.

FAMILY LIBELLULIDÆ.

Subfamily Cordulianæ.

Idionyx corona, Fraser, Bombay N. H. Journ., XXVII, pp. 690-691 (Sept. 1921). (Plate VII, fig. 5.)

A single female from the Bababuddin Hills, Mysore, 4,700 feet, 1st June 1915 : T. V. Ramakrishna Ayyar coll.

Abdomen 22 mm. Hindwing 38 mm. (The last five segments of the abdomen are missing ; the probable length of the whole would be about 40 mm.)

Head. Eyes large and globular, probably deep sea-blue during life, now reddish brown, moderately fused. Occiput small, black, with a tuft of stiff black hairs in the middle line and fringed behind with long yellow hairs, this fringe being continuous around the posterior margin of the eyes. Vesicle remarkably developed into a long, elevated spine shaped like the double crown of ancient Upper and Lower Egypt and 2·75 mm. in length, bluish black. Frons with a deep fissure, bronzed green or bluish green above and in front ; epistome black ; labium yellowish at the base, broadly blackish brown along the border as is also the labrum.

Thorax bronzed green marked by a narrow, bright yellow, lateral stripe which traverses the spiracle. The posterior border of the metepimeron bright yellow. Above blackish brown, unmarked.

Wings enfumed diffusely around the areolar network, the centres of the cells being clear. A diffuse saffronation along the costa as far as the stigma and most markedly at the base. Membrane white tinged with brown posteriorly. Stigma black unbraced, not quite 3 mm.

A single row of discoidal cells nearly as far as the node. Hypertrigone traversed once in the forewing, entire in the hind. Arc at the 2nd antenodal nervure. Loop 11 cells. Only 2 rows of cells posterior to Cu_1.

Nodal index :— $\frac{8\ 13}{9{\cdot}9}\Big|\frac{12{\cdot}7}{9{\cdot}9}$ Cu_1 angulated at its origin in the hindwing and rather lost in the general network in the right wing.

Abdomen black or bronzed black, unmarked save for a fine, middorsal, apical, yellow line on the 2nd segment.

Legs black, coxæ yellow, tibiæ yellowish or pale brown on the extensor surfaces. Moderately long and slim. Hind femora with a row of closely-set, long, evenly sized, fine spines. Tarsal claws bifid.

Type in the Pusa collection.

Idionyx corona race *nilgiriensis*, nov.

Two females, Burliyar, Nilgiris, 2,500 feet, 29th July 1921, collected by Major F. C. Fraser.

These females much resemble *I. corona* and cannot, I think, be regarded as specifically distinct. They differ as follows :—

The vesicle is shaped as a smooth horn of the same dimensions as in the type but is not indented in front (Possibly the vesicle in *I. corona* may have been indented artificially). [I do not think that this is so.—T. B. F.]

The dimensions vary :—abdomen 35 mm., hindwing 35 mm.

The eyes are a beautiful bottle green capped with reddish brown, the extent and position of the latter changing according to the angle at which the eyes are viewed.

The epistome has a small, yellow triangle at its lower part ; the labium is entirely bright yellow ; the labrum is not bordered with black.

The wings are perfectly hyaline but have saffron streaks in the subcostal and cubital spaces extending as far as the trigone. The nodal index varies widely. In one specimen it is :— $\frac{9\cdot17}{10\cdot10}\left|\frac{15\cdot8}{10\cdot10}\right.$ and in the other $\frac{8\cdot14}{10\cdot2}\left|\frac{13\cdot8}{9\ 10}\right.$.

The abdomen is black marked with yellow along the lower part of the sides of segments 1 to 4 and there are fine basal annules to segments 3 and 4. The fine, yellow line on the middorsal carina of segment 2 is absent. The end of the abdomen is not dilated.

Habitat. These two specimens were taken together in the bed of a rocky, mountain stream, both in the act of ovipositing in wet sand.

Type of *I. corona nilgiriensis* in Major Fraser's collection.

Idionyx ornata, Fraser, Bombay N. H. Journ., XXVII, p. 691 (Sept. 1921). (Plate VII, fig. 6.)

A single female from Shillong, 2nd June 1920, collected by T. Bainbrigge Fletcher.

" Taken in jungle and difficult to see on the wing."

Abdomen 38 mm. Hindwing 36 mm.

Head relatively large ; face brownish yellow, the upper part of frons a deeper colour and slightly metallic ; labium reddish brown, dark ; vesicle dark yellow, highly developed and projecting as a blunt spine but not to the same extent as in *I. corona*. Eyes probably deep blue during life but now reddish brown ; occiput small, black.

Thorax small, metallic green, marked with bright yellow as follows :— antehumeral, oval spots not extending above halfway to the alar sinus, well defined and pointed below ; alar sinus yellow ; a lateral, broad stripe and the posterior border of the metepimeron more or less broadly yellow. Above blackish but crossed by a yellow stripe which connects up laterally with the yellow stripes.

Legs slim, coxæ yellow, femora and tarsi black ; tibiæ bright yellow with black spines.

Abdomen long, laterally compressed, broadening towards the anal end, shiny black, the ventral borders of segments 2, 3 and 8 marked with bright yellow. The dorsum of the second segment broadly and that of the third and basal half of the fourth finely marked with pale yellow. Anal appendages short, pointed, black.

Wings hyaline, saffronated at the bases only as far as the second antenodal nervure. Membrane white ; stigma black, covers $2\frac{1}{2}$ cells.

Nodal index :— $\frac{9\cdot13|13\cdot 8}{10\cdot 9|\ 9\cdot11}$. One row of discoidal cells nearly as far as the node in the right wing, beyond the node in the left forewing ; hypertrigones traversed twice in the forewings, once in the hindwings ; 3 rows of cells posterior to Cu_1 in the forewing ; 13 to 16 cells in the loop.

Until the males of these two insects are found, their position will remain uncertain. At present the peculiar development of the vesicle separates them rather sharply from other species of the genus.

Type in the Pusa collection.

Macromia atuberculata, sp. nov.

A single male from Hasimara, Duars, Bengal (without date), collected by C. M. Inglis.

Male. Abdomen 44 mm. Hindwing 37 mm.

Labium brown ; labrum black, the lateral lobes bright yellow ; epistome black marked with yellow, a broad yellow stripe across the lower part of frons, two small spots at about the centre of the face, and a somewhat larger spot on each side against the eyes. Frons metallic green. Eyes probably emerald green during life ; occiput black.

Prothorax brown spotted with yellow.

Thorax metallic green marked with yellow as follows :—a bright citron yellow humeral stripe, the antealar sinus, a moderately broad, oblique stripe about the middle of the side and a small spot on the hinder part of the metepimeron. Beneath, thorax yellow marked with a triangular spot of black posteriorly and two oval spots of black.

Legs long and rather slender, black, the coxæ and bases of the femora yellow.

Wings hyaline, unmarked at the base ; stigma black, small ; two rows of discoidal cells ; one row between Rs and Rspl ; all trigones and subtrigones entire ; loop made up of 6 to 7 cells ; nodal index $\frac{8\cdot15|15\cdot6}{9\cdot10|11\cdot8}$, membrane black, hypertrigones traversed four times in forewing, twice in the hind.

Abdomen black marked with yellow as follows :—a small, basal, lateral streak on the first segment; segment 2 almost entirely yellow, but with an irregular, apical band of black; segment 3 with a semilunar, lateral, basal streak and a subdorsal, triangular spot which is almost confluent with its fellow on the far side of the segment; segments 4, 5 and 6 similar but without the basal spot; segment 7 has a rather broad, yellow annule at the base which on the dorsum is prolonged back as a small, quadrilateral tongue along the dorsal carina; segment 8 has a fine, basal, dorsal line and a streak along the side very low down; segments 9 and 10 are entirely black; segment 10 differs from that of all other species of *Macromia* by having its dorsum quite smooth and without the usual tubercle or tubercles.

Superior anal appendages black, armed with a robust spine at the outer side of the apical third. Inferior black, subtriangular, curling up at its apex.

The smooth character of the tenth segment will serve to distinguish this species from all others.

Type in the Pusa collection.

FAMILY ÆSHNIDÆ.

Subfamily Gomphinæ.

Platygomphus martini, sp. nov.

Male and female from Shillong, 6th and 17th June 1920, collected by T. Bainbrigge Fletcher.

Abdomen 37 mm. in both sexes, hindwing 30 mm. in male, 32 mm. in female.

Both sexes exactly similar in colouring.

Male. Head black with the exception of the foreborder of the frons and the lateral lobes of the labrum which are bright yellow. Occiput with no special armature.

Prothorax black spotted with yellow.

Thorax black in front and on the dorsum, yellow on the sides. A narrow mesothoracic collar which is just divided in the middle and joined to the antehumeral bands so as to form inverted "7"s. Laterally, there are two narrow, black stripes on the first and second lateral sutures, the latter curving back along the posterior and lower margin of the metepimeron. The tergum is spotted with yellow.

Legs very long and robust, entirely black.

Wings hyaline, the extreme base with a slight saffronation only ; stigma black, about one-fourth the length of the distance between the node and the distal end of stigma, feebly braced ; four rows of post anal cells in the hindwing, two for a very short distance in the forewing ; only one nervure between $M_{1\,3}$ and M_4 in the hindwing, three in the forewing ; two rows of discoidal cells nearly as far as the node ; two rows of cells between M_1 and M_2 beginning nearer the stigma than the node ; nodal index $\frac{12\cdot17}{12\cdot12}\left|\frac{8\cdot11}{12\cdot13}\right.$. Two rows of cells between M_1 and M_{1a} at outer end of stigma. No basal postcostal nervure.

Abdomen dilated at the base and also at the sides of segments 7 to 9, black, marked with yellow as follows :—first segment all yellow except for two subdorsal, transversely oval, black spots, second segment with the middorsum broadly yellow, the edges of this marking constricted in two places, the sides striped with yellow and the auricles of the same colour, third to sixth segments with the dorsum very finely yellow, but this broadening a little towards the base of the segments where the yellow expands into narrow yellow annules, the third segment has also a short yellow stripe at the sides adjacent to the base, seventh segment with a broadish annule at the base which tapers away apically along the dorsal carina, eighth segment with the dorsum finely yellow, ninth and tenth all black.

Anal appendages both divaricate, the superior yellow, the inferior black, both thick at the base and tapering to a point, about as long as segment 10.

This insect differs from *Platygomphus feœ* and *P. dolobratus* by the face which is largely black, marked with yellow (instead of largely yellow with sparse black markings), by the absence of yellow spots on the dorsum of the thorax between the antehumeral lines, by the complete lateral stripes on the sides of thorax, and finally by the great abbreviation of the markings on segments 3 to 6. The sides of the terminal segments are also entirely black.

Type (male) and co-type (female) in the Pusa collection.

Stylogomphus, gen. nov.

Segments of abdomen gradually diminishing in length from 7 to 10 ; appendages a little longer than segment 10, the superior curved, at first divaricate and then approximating and with the ends overlapping, the inferior cleft for about half its length, the two branches parallel.

Wings. All trigones and hypertrigones entire, the trigone of the hindwing rather elongate ; no basal antenodal of the 2nd series ; the stigma comparatively small, less than one-fourth the distance between node and distal end of stigma in the forewing ; sectors of arc not approximating ; M_4 and Cu_1

nearly parallel throughout their length, only 7 cells between at the termen ; no trigonal supplement ; only one nervure between $M_{1\ 3}$ and M_4 in the hindwing, two in the forewing ; only one cubital nervure to all wings ; one row of cells between M_1 and M_1a ; stigmas braced ; one row of cells between M_1 and M_2 to within 2 cells of the stigma ; three rows of postanal cells in the hindwing, only one row in the forewing ; forking of $M_{1\text{-}2}$ and M_3 symmetrical in both wings ; the distal angle of the trigone in the hindwing not separated from M_4 by a stalk.

Legs robust and moderately long, all the femora spined minutely.

Genotype : *Stylogomphus inglisi*, Fraser.

Stylogomphus inglisi, sp. nov. (Plate VII, figs. 3, 3a and 3b.)

One male from the Tista River, Darjiling District, 1,500 feet, 8th June 1920, collected by C. M. Inglis.

Length of abdomen with appendages 25·5 mm. Hindwing 21 mm.

Head black marked with bright yellow as follows :—a transverse streak on the upper part of frons, a median streak on the lower part of epistome, a ateral spot on the labrum and the labial palps. No prominences on the occiput.

Prothorax black marked with yellow on the posterior lobe.

Thorax black on the dorsum, yellow on the sides. A complete, mesothoracic collar present. The front bearing longish, oval, yellow spots which converge on each other above but do not meet the mesothoracic collar nor the alar sinus. The sides marked with a pair of irregular black, narrow stripes which are connected by a narrow isthmus about half-way up the sides. Tergum spotted with yellow.

Legs black, the coxæ and trochanters yellow.

Wings saffronated at the extreme base ; stigma black ; costa black.

Nodal index $\frac{9\cdot12}{9\ 9}\Big|\frac{11\ 9}{7\ 9}$.

Abdomen black marked with yellow as follows:—the sides of the first segment broadly and a stripe on the dorsum which is continuous with a similar stripe on the second (on the latter, however, it shows a median dilatation), the sides of the second broadly, and the upper surfaces of the oreillets.

A middorsal, oval, basal spot on segment 3, as also its base laterally, and finally, narrow lunules at the bases of 4, 5 and 6 slightly interrupted on the dorsum. The rest black.

Anal appendages unlike any other species of *Gomphine* that I know of. The superior very long and attenuated, pale yellow, broad at the base where they are a little convergent and then curving first out and again in to fine

points which overlap one another ; seen in profile they curve strongly downward and at the tips sweep up again in a fine curve ; laterally there are two, equal, robust, blunt tubercles not amounting to spines. The inferior black, triangular, not as long as the superior, the apex split to about the middle of the appendage ; seen in profile the appendage is slightly curved with its convexity above and nearly parallel to the superiors.

This species approaches closest to *Onychogomphus modestus*, Selys, but is distinguished by its appendages and also by the following features : the superior appendages are all yellow instead of browny black at the apical half, segment 7 is all black and has no broad, yellow, basal spot, the nodal nervures are fewer, the size is smaller and, lastly, the mesothoracic collar is whole (broken in *modestus*).

The genus differs from *Onychogomphus* as follows :—

i. There are only 3 rows of postanal cells in the hindwing.

ii. The anal area in the forewing proximal to the trigone has only one row of cells.

iii. The first postanal cell is undivided.

Type in the Pusa collection.

Leptogomphus spirillus, sp. nov. (Plate VII, figs. 2 and 2a.)

One male, collected at mile 23, on the Gauhati-Shillong Road, at an elevation of about 1,000 feet, on 2nd August 1919, by T. Bainbrigge Fletcher. One male (type) from Tura, Garo Hills, Assam, collected by S. Kemp, June-July 1917.

Male. Abdomen 32 mm. Hindwing 28 mm.

Head black, the frons bright yellow along the foreborder. Occiput black without armature.

Prothorax black with a fine, yellow collar in front, a lateral spot of the same colour on either side and a geminate spot on the posterior lobe.

Thorax black in front on the dorsum, bright greenish yellow at the sides. A complete mesothoracic collar which is not connected to two humeral, oval, yellow spots ; these latter do not reach as far as the alar sinus and converge on each other above. The tergum spotted with yellow. Two narrow, black lines on the 1st and 2nd lateral sutures.

Legs black, the coxæ yellow.

Abdomen black marked with yellow as follows :—the first segment narrowly at the base on the dorsum and broadly on the sides ; second segment with a dorsal spot shaped like the head of an arrow with its apex directed

back, a lateral spot and the upper surface of the oreillets ; third segment with the dorsal carina narrowly, this marking tapering away towards the apex ; fourth to seventh segments with the dorsal carina finely yellow, or this marking may be entirely absent. Rest of abdomen all black.

Anal appendages highly specialized, the superior bright yellow, the inferior black. Superior appendages longer than segment 10, curling cork screw fashion, first outward, then in and finally outward again, the end finely pointed, gradually tapering to the end ; on its outer side, near the base, a strong spine. Inferior appendages nearly as long as the superior, markedly divaricate.

Wings hyaline, stigma black, about one-fourth the length of the distance between the node and the distal end of stigma, braced ; 2 to 3 nervures between M_{1-3} and M_4 in the forewing, only one in the hindwing ; no basal postcostal nervure ; arc opposite the second antenodal nervure ; five rows of postanal cells in the hindwing, two in the forewing ; two rows of discoidal cells as far as the node ; all trigones, subtrigones and hypertrigones free ; two rows of cells between M_1 and M_2, beginning nearer the stigma than the node ; 16 antenodal nervures in the forewing, 13 postnodals, 10 and 11 respectively in the hindwing. Anal excavation of hindwing very shallow.

Type (male), from the Garo Hills, in the Indian Museum collection. Co-type, from the Khasi Hills, in the Pusa collection.

Gomphus bicornutus, sp. nov.

A single female from Shillong, 18th June 1920, collected by T. Bainbrigge Fletcher, "hovering over a stream."

Abdomen 47 mm. Hindwing 40 mm.

Female. Head black above, the frons along its foreborder bright yellow. Face black, marked with yellow as follows :—the epistome narrowly where it borders on the labrum, the lateral lobes of the labrum and two transversely oval spots on the labrum itself. Labium black. The occiput furnished with two long, medial spines which project backward and resemble those of *Onychogomphus cerastes* but are much longer and more robust. (The insects differ from each other in all other respects and are not readily confused.)

Prothorax black marked with yellow.

Thorax largely black, marked with bright yellow as follows :—an antehumeral stripe joined to a mesothoracic collar so as to form inverted " 7 "s. The collar finely divided in the middorsum. A small, round, humeral spot near the alar sinus, a broad, posthumeral stripe and the greater part of the metepimeron. In addition to these markings there are two small spots on the

lateral black, one above near the root of the wings and the other below near the hind coxa. Tergum spotted with yellow.

Legs stout, short, finely spined, black, the trochanters yellow.

Abdomen black, marked with bright yellow as follows :— the first segment with a large, lateral spot at the apical half and a smaller, triangular, dorsal spot at the apical border, second segment almost wholly yellow and only marked finely with black at the apex, the black projecting basalwards on the middorsum, third segment with nearly the basal half yellow on the dorsum and less so on the sides, segments 4, 5 and 6 with only small, basal, semilunar spots just meeting over the middorsum, segment 7 with rather more than the basal half yellow, remaining segments black.

Anal appendages small, conical, black.

Wings saffronated at the base as far out as the trigones and rather further in the subcostal space. Stigma braced, black, rather more than one-fourth the length of the distance from the node to the distal end of the stigma. Nodal index $\frac{14.18|18.15}{15.14|14.16}$ Two rows of cells in the discoidal field as far as the node ; two rows between M_1 and M_2 beginning nearer the node than the stigma ; six rows of postanal cells in the hindwing, two in the forewing ; no basal antenodal nervure of the second series ; only one transverse nervure between M_{1-3} and M_4 in the hindwing, two in the forewing ; arc opposite the second antenodal nervure ; all trigones, hypertrigones and subtrigones entire.

This fine insect can be distinguished from all other Gomphines by the armature of the occiput.

Type in the Pusa collection.

Gomphus risi, sp. nov.

A single female from near Mangpu, Darjiling District, 3,400 feet, 31st August 1920, collected by C. M. Inglis.

Length of abdomen 49 mm. Length of hindwing 42 mm.

Female. Face largely black, labium yellow, labrum black with two basal spots of yellow at the outer angles, the labial palps of the same colour. Epistome with a fine margin of yellow at the lower part and a small spot of the same colour on each side touching the eyes ; frons with a band of yellow on its foreborder ; occiput black, furnished with two small points at the middle of its posterior border.

Prothorax black with two small spots of yellow on its middle lobe.

Thorax black marked with yellow as follows :—a mesothoracic collar not broken in the middle line, a fine line on the midthoracic carina, narrow

antehumeral stripes which do not meet the mesothoracic collar, a small, posthumeral spot at the upper part of thorax, a broad, lateral stripe and the whole of the metepimeron. Between these two latter markings are the rudiments of a third lateral stripe represented by a spot below and two spots above.

Legs black, short, yellow on the flexor surfaces of the femora.

Wings hyaline ; stigma black, braced, more than one-fourth as long as the distance between the node and the distal end of stigma ; no basal antenodal of the second series ; all trigones, subtrigones and hypertrigones entire ; two rows of discoidal cells as far as the level of the node ; four rows of postanal cells in the hindwing, 2 in the fore ; nodal index $\frac{14.20}{12.12}\Big|\frac{18.12}{13.11}$; two transverse nervures between $M_{1\text{-}2}$ and M_3 in the forewing, 1 in the hind ; arc opposite the second antenodal nervure ; 2 rows between M_1 and M_{1a} beginning nearest the stigma.

Abdomen black marked with yellow as follows :—first segment with a dorsal spot extending its whole length and a large, lateral spot ; second segment similarly marked, the dorsal spot tapering apically ; third to sixth segments with triangular, basal spots, about one-fourth the length of the segments, which nearly meet over the dorsal carina ; seventh segment with the whole of its basal half yellow, the black encroaching on it dorsally ; eighth to tenth segments entirely black.

Anal appendages small, pointed, conical, black.

This fine insect, one of our largest Gomphines, closely resembles *Gomphus xanthenctus*, Williamson, but differs from it by having the mesothoracic collar undivided in the middle line, by the antehumeral stripe not joining the mesothoracic collar and by the incomplete stripe between the two lateral thoracic stripes, etc.

Type in the Pusa collection.

Onychogomphus echinoccipitalis, sp. nov.

A single female taken whilst ovipositing over a stream, at mile 23 on the Gauhati-Shillong Road, at an elevation of about 1,000 feet, on 2nd August, 1919, by T. Bainbrigge Fletcher.

Abdomen 34 mm., hindwing 35 mm.

Female. Head black marked with yellow. The face olive green, the lower part of epistome paler ; labrum and lateral lobes yellow, the base of former narrowly black. A bright yellow stripe across the front of frons, interrupted in the middle by the suture which is black. Occiput fringed posteriorly with a row of fine spines to the number of about twelve.

Thorax black marked with yellow as follows :—an interrupted mesothoracic collar ; antehumeral stripes which are well separated from the collar ; some spots on the tergum and, lastly, two lateral stripes which have the borders a little diffuse.

Legs stout, short, black, the femora striped with yellow.

Wings hyaline ; stigma black, equal to about one-third the distance between the node and the distal end of stigma ; trigones, subtrigones and hypertrigones free, but the hypertrigone in the left forewing is traversed twice and there are the beginnings of nervures in the subtrigone and trigone of the same wing (these are evidently aberrations); two rows of discoidal cells nearly as far the node in the forewing ; two rows of cells between M_1 and M_2, beginning nearer the stigma than the node ; five to six rows of cells in the postanal area of hindwing, two rows in the forewing ; nodal index $\frac{9.21}{10.11}\left|\frac{18\cdot10}{12\cdot10}\right.$; only one nervure between M_{1+3} and M_4 in the hindwing, two in the forewing.

Abdomen very stout and of even width throughout, black, marked with yellow as follows :—first segment yellow laterally and with an apical annule which broadens at the middorsum ; second segment yellow laterally, the yellow being traversed obliquely by a narrow black line, a bilobed, lanceolate, dorsal spot ; third segment with a large, basal, subtriangular spot covering about the basal half of the dorsum ; fourth to seventh segments with similar but rather smaller spots whilst that on the seventh is more quadrate than subtriangular ; eighth and ninth segments with small, semilunar, subdorsal, basal spots on either side, the joints between these segments being finely yellow ; tenth segment entirely black.

Anal appendages very small, conical, pointed, black.

So long as the male of this species is unknown, it cannot be certain that it belongs to the genus *Onychogomphus*. Mr. Bainbrigge Fletcher took the specimen practically in company with another Gomphine, *Leptogomphus spirillus*, a male, which however differs entirely in its generic characters and cannot be the male of this species. So far as the character of the wing venation goes, the specimen must belong to the genus *Onychogomphus*.

Type in the Pusa collection.

Subfamily Æshninæ.

Gynacantha bainbriggei, sp. nov.

Three males from Gauhati, 16th to 19th November 1919, collected by T. Bainbrigge Fletcher.

Male. Abdomen 50 mm. Hindwing 47 mm.

Head. Eyes opalescent bluish grey, frons pale brown with a not very well defined, black, T-shaped mark above ; face pale brownish yellow without markings ; occiput very minute, yellow ; basal joint of antennæ ochreous ; ophthalmic suture with a fringe of longish hairs.

Prothorax brown at the sides, diffusely black on the dorsum.

Thorax pale brown, with darker middorsal and humeral fasciæ through which runs a fine dark line. No lateral markings.

Abdomen pale brown marked with shades of grey and black and a pair of sky-blue spots at the distal end of each segment, except the first, eighth, ninth and tenth ; on the third segment, a pair of spots of the same colour at the proximal end ; the distal spots are edged apically and outwardly with black, this colour being continued forward subdorsally and tapering away until finally lost ; on the last three segments the black entirely obscures the spots. The oreillets are large and coloured sky-blue above, the posterior border minutely toothed.

Anal appendages very long and narrow, 7 mm., fringed inwardly with very long hairs.

Legs black, brown at the base of the femora.

Wings hyaline, the stigma pale brown, 3·5 mm. Forewing with 26 antenodal nervures and 21 postnodal ; hindwing with 21 antenodal and postnodal nervures; hypertrigones traversed 6-8 times, trigones variably traversed by 3-5 nervures which may or may not form a net-work; loop with 11-13 cells.

Habitat. Gauhati, Assam. The specimens were beaten up from dense jungle during the daytime and are evidently crepuscular in habits.

Note. The above description was drawn up by Major Fraser from a spirit specimen. The eyes in life are bright green. This species is found by day in bamboo jungle at Gauhati.

Type (a spirit specimen) in the Pusa collection.

Another male specimen, taken at Gauhati on 13th April 1920, and named as *G. bainbriggei* by Major Fraser, was noted as having the following coloration when fresh :— eyes green ; thorax green with blackish markings, a blue spot at base of each wing, a blue spot between the hindwings and a large blue spot dorsally posteriorly ; second abdominal segment green with narrow blue transverse stripe and blue oreillets, other segments brown with green spots posteriorly obsolete on the last three segments.

This species was also found commonly at Margherita, N.-E. Assam, in May 1920.— [T. B. F.]

Gynacantha hanumana, sp. nov.

A single male from Mangpu, Darjiling District, 5,200 feet, 18th February 1920, collected by C. M. Inglis.

Abdomen 43 mm. Hindwing 44 mm. Anal appendages 4·5 mm.

Male. Head ashy, a thick, black, T-shaped mark on the upper surface of frons.

Prothorax pale brown, darker on the dorsum.

Thorax pale ashy grey, the middorsal carina diffusely black. The sides clouded with dark sooty grey.

Wings a little enfumed but the bases unmarked. Stigma whitish yellow, the postcostal margin black-bordered. Loop 12-13 cells ; 8-10 cubital nervures in the forewing, 7 in the hind ; 5-6 supplementary nervures to the bridge in the forewing, 4-5 in the hind ; sectors of arc arising from the middle of arc, the latter being situated between the third and fourth antenodal nervures ; trigone of forewing traversed 4 times, the innermost nervures being joined to the basal side by a short nervure, 3-4 times in the hindwing ; M^4 with a dilatation at the angle which it makes as it turns down abruptly to meet the termen ; 4-6 rows of cells between Rs and Rspl and Mspl and M_4 ; hypertrigones traversed 5 or 6 times ; nodal index $\frac{19 \cdot 26 | 24 \cdot 18}{20.19 | 19.21}$. The stigma of forewing, 3·7 mm., is a little larger than that of the hindwing, finely braced, the brace being a little sinuous.

Legs ochreous, the hind femora with a row of very short spines, longer at the distal end ; tibial spines long and numerous ; claw-hooks robust.

Abdomen long and parallel-sided, transverse ridges on the second to the eighth segment, segment 3 well constricted, oreillets moderately large. Bluish grey in colour, the dorsum of segments broadly brownish black, especially apically. The third segment, basal to the transverse ridge, entirely pale blue, the oreillets bright blue narrowly margined with black. Each segment from 3 to 8 has a pair of subdorsal, blue spots at the apical end.

Anal appendages very long and slender, the inferior being 2-5ths the length of the superior, blackish brown, the superior fringed inwardly with long, black, stiff hairs. The superior have the inner margin very sinuous and the apex pointed.

This insect is the size of *G. bayadera* but is distinguished from it by the complete, black T-shaped mark on the upper surface of frons and by the greater number of ante- and post-nodal nervures.

Type in the Pusa collection.

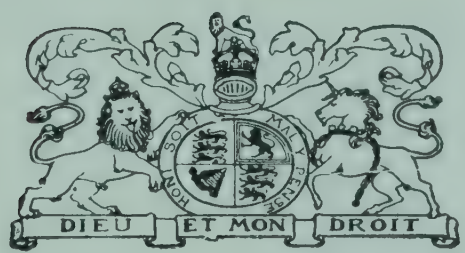
June 1922 ENTOMOLOGICAL SERIES Vol. VII No. 8

MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

FURTHER NOTES ON *RHINOCYPHA* LARVÆ

BY

MAJOR F. C. FRASER, I.M.S



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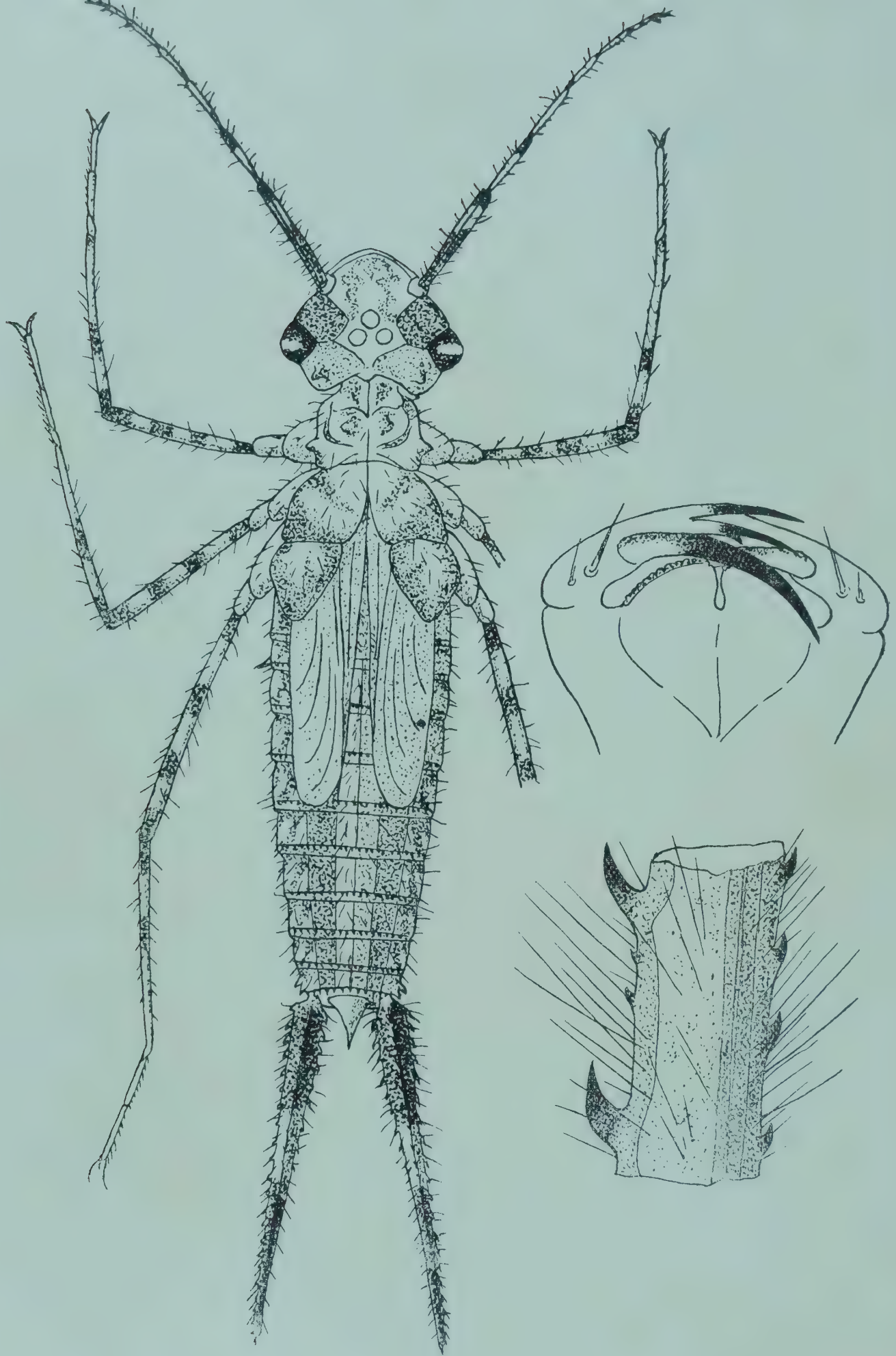


ADULT LARVA OF *RHINOCYPHA IGNIPENNIS.*

FURTHER NOTES ON *RHINOCYPHA* LARVÆ.

BY

MAJOR F. C. FRASER, I.M.S.

[Received for publication on 3rd December 1921.]

THE ADULT LARVA OF *Rhinocypha ignipennis* (Plate IX).

IN the Memoirs of Pusa, Entomological Series, Vol. VII, No. 2, June 1920, I described the young larva of a *Rhinocypha* which Mr. Bainbrigge Fletcher showed was that of *R. ignipennis*. Several adult larvæ have since been taken by the same collector so that I am now able to add to the previous description and to correct the wrong impression I had formed that these larvæ do not possess caudal gills.

Caudal gills are certainly absent in the first two instars as in the majority of Zygopterous larvæ, breathing being purely rectal or taking place through the thin cuticle, the gills being either undeveloped, hairy or filamentous. In the young larvæ of *ignipennis* they are certainly absent or the autotomy must be extraordinarily neat.

If a comparison be made between the young and adult instars, great changes will be noted, the legs for instance, which are enormously out of proportion to begin with, fail to keep pace with the growth of the trunk and eventually compare well with the length of the body.

There are some smaller but important changes in the mask which flattens and lengthens, the middle lobe becoming fairly deeply cleft.

The caudal gills develop, closely paralleling those of *Micromerus*, and the usual changes associated with the development of the wing sheaths take place in the thorax.

The whole appearance of the larva is strikingly like that of *Micromerus* and differs only in detail. The plate given here of *R. ignipennis* should be compared with that given for *Micromerus lineatus* in the *Records of the Indian Museum*, Vol. XVI, Part 11, No. 9, 1918.

The antennæ are sparsely hirsute, the pedicel is strongly ribbed longitudinally, pigmented at its apex and the basal half, the second joint is also pigmented apically.

The eyes are small, projecting laterally and are deeply pigmented with blackish brown, this colour also covering a contiguous area of the epicranium which gives a false idea of the size of the eyes.

The frons is mottled with a serpiginous pattern of brown. On the occiput are found two prominent, dorsal spines, situated on the postocular lobe and nearer the middle line than in *Micromerus*, and its posterior border is deeply concave. On the synthorax there are two dorsal spines situated near the middle of the pronotum and also two lateral ones. The mesopleura are more square and the metapleura rounder than in *Micromerus*. The legs are very similar to those of the same insect, but the distal pigmented band on the femur is darker and there are apical and subapical bands on the tibiæ as well. The caudal gills are armed with more robust spines and the basal third and apical half are deeply pigmented in some specimens or only in the basal half of others. The armature varies, the spines being closely or widely set and the number varying. The *appendix dorsalis* is represented by a median, conical eminence lying between the two caudal gills.

The adult mask is almost identical with that of *Micromerus*, the fissure being either open or its edges overlapping apically so as to enclose a small foramen. It is remarkably flattened, and elongated, reaching in juveniles to the base of the hind legs and in adults to the middle pair.

The gizzard, which was examined with some difficulty owing to the larvæ having hardened in alcohol, has sixteen folds, each bearing a row of four to five teeth.

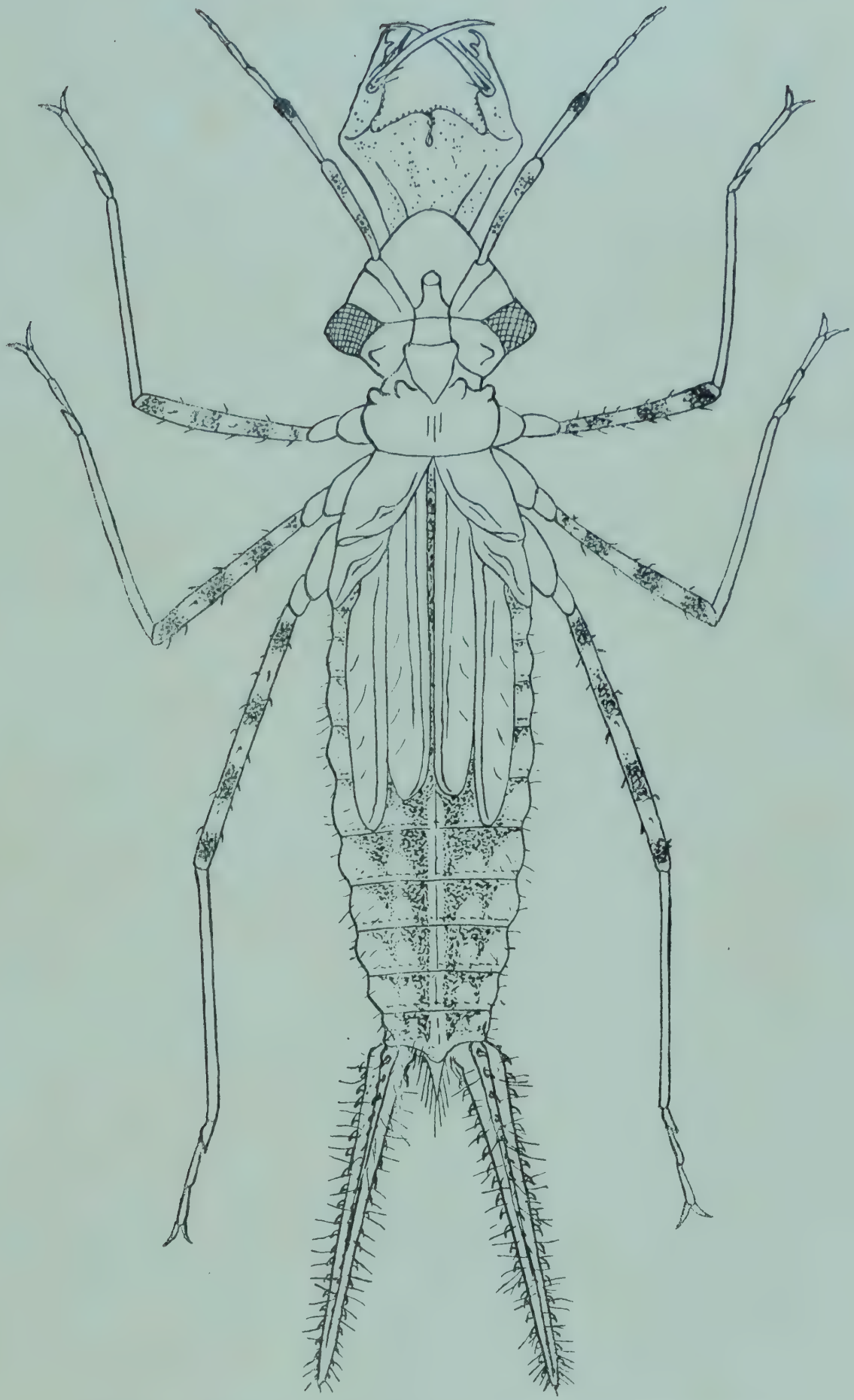
The total length of the adult larva is 24·5 mm., abdomen 11 mm., caudal gills 7·5 mm.

The larvæ were collected in running streams on débris in turbid water at Shillong on 11th May 1920.

DESCRIPTION OF THE LARVA OF *Rhinocypha bisignata*, SELYS (Plate X).

One larva from Kallar, Nilgiri District, *ca* 1,500 ft., collected by T. Bainbrigge Fletcher, 27th February 1920. One exuvium from Khandala, *ca* 2,000 ft., 8th May 1920.

The former specimen was taken amongst weed, the latter was found clinging to a clay bank about six inches above the water line of a small stream over which a large number of the adult insect was flying or perched on twigs overhanging the stream.



ADULT LARVA OF *RHINOCYPHA BISIGNATA*, SELYS.

The females of this insect and of *Micromerus lineatus* are difficult to distinguish from one another when at rest and if no males be present, the only guide to go upon, unless the insects be captured and examined, is the relatively larger size of the former. The two insects are rarely found together although they may occur in the same district and prefer similar haunts, such as a rapidly flowing stream, overhung and densely shaded by trees and shrubs. Both breed in rapidly flowing, and clear streams.

Bearing these facts in mind, it is not surprising to find that the two larvæ bear the closest resemblance. To bring this out, I have sketched the larva of *R. bisignata* of the same size as that of *M. lineatus*, shown in the *Records of Indian Museum*, Pl. XXIII, p. 198, Vol. XVI (1918), although the former is actually and relatively larger.

In *R. bisignata* the pigmentation on the legs and abdomen is of a more uniform density and that of the abdomen is of a less intricate character than in *M. lineatus*. The second joint of the antennæ has two pale brown rings and the third is tipped distally with blackish brown, the remaining segments being unpigmented. The caudal gills are shorter and armed with more robust spines.

The mask is similar in shape but the fenestration and overlapping of its edges is not so well marked. The lateral lobes are armed with three hooks and, viewed laterally, resemble a three-fingered hand ; the upper hook is long, slender and jointed at its base, the middle one about half the length of the former, whilst the inferior hook is laminate and bifid at its extremity, thus resembling the cheliped of a crab. The lobes overlap widely across the middle line.

The close resemblance between the two larvæ suggests a closer alliance between *Micromerus* and the Group *bisignata* of *Rhinocypha* than exists between the latter and the remaining groups.

NOTES ON INDIAN DIPTERA.

BY

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I. NOTES ON THE DIPTERA OF THE KHASIA HILLS.

CECIDOMYIDÆ.

Asphondylia osbeckiæ. (sp. nov.) A single female, taken early in the morning on flowers of *Osbeckia*, was the only member of this family obtained during the tour. The extraordinary angulated ovipositor (Plate XV, fig. 1) shows special adaptations of an unknown nature. Hitherto only one species has been known from the Khasia, in fact our very fragmentary acquaintance with the family in India is almost entirely confined to Ceylon and the South Indian part of the Ceylonese province. The family must be as abundantly represented in the Assam Hills as anywhere in the East, but it needs special methods of collecting, and hence, in a tour of this nature, numerous captures in it were not to be expected. No deformations on *Osbeckia* were noticed, but no special search was made.

MYCETOPHILIDÆ.

Until now only three species of this family have been recorded from the Hills. A considerable number are known from Sylhet, but what knowledge we have of the family in India is otherwise almost entirely confined to the Himalaya and Ceylon, and many instances of double distribution recorded cannot safely be accepted until the Hills of the Peninsula have been worked.

Sciara brunniventris. (sp. nov.) The unique type was taken at Cherrapunji.

Sciara sp. (near *diversipes*, Brun.). A female from Shillong, in jungle, is either this Eastern Himalayan species or so near it that I cannot separate it with certainty. It differs by the less thickened antennæ and the pale mid femora.

Sciara flavicollis. (Brun.) Taken at Cherrapunji and Dumpep.

Sciara fletcheræ. (sp. nov.) The unique type of this beautiful and distinct species was kicked up among long grass on the river bank at Laitlyngkot, and was taken resting on the author's back by the Imperial Entomologist.

Sciara hirtilineata. (Brun.) A single male, in jungle, Shillong, is this species, previously recorded from the Himalaya, west and east.

Sciara hirtilineatoides. (sp. nov.) Two specimens, Shillong.

Sciara khasiensis. (sp. nov.) The unique type was another of the notable results of a dull, cold day in unpromising-looking country at Laitlyngkot.

**Sciara nigripennis.* (Brun.) Three specimens from Shillong and one from Cherrapunji. The only member of the genus previously recorded from the Khasia,—widely distributed, known also from Simla, Kumaon, Darjiling, Sarawak and Ceylon (Pattipola, 6,000 feet).

Sciara sp. A female in bad order, from Laitlyngkot, I cannot identify. It runs down to *parallela* in Brunetti's key,—in other words, it possesses no distinctive characters of any kind.

**Mycomyia ferruginea.* (Brun.) Four specimens, all from Shillong, two taken in pine forest. Known also from Darjiling, Calcutta and Peradeniya. On the wing it is distinctly a hymenopterous mimic.

**Allactoneura cincta.* (de Meij.) Specimens from Nongpoh, Shillong and Cherrapunji. The species is widely distributed, being known from Nepal and Ceylon to Formosa. Previously recorded in Assam from Sylhet and Kobo (N. E. frontier).

Exechia brevicornis. (sp. nov.) The unique type in pine forest, Shillong.

Exechia longicornis. (sp. nov.) Very like the preceding, but the antennæ are much longer; both species being known from males. Shillong, in deep shade.

Exechia flava. (sp. nov.) Cherrapunji. This is very near Brunetti's *basilinea* from the Himalaya, but is, I think, distinct. The uncompressed abdomen is hardly in accord with the other species of the genus known to me.

Exechia mirastoma. (sp. nov.) The unique type of this species, the extraordinary mouth parts of which, when understood, will doubtless involve the erection of a new genus for its reception, was taken in pine forest, Shillong. It is greatly to be hoped that sufficient material will come to hand to enable the structure to be properly made out. I do not care to mutilate the unique type.

The discovery that this genus, hitherto only known as Indian on one species from the Himalaya, is common in the Khasia and Ceylon, is a better proof of community of fauna than many specific identities.

Mycetophila khasiensis. (sp. nov.) The unique type from Shillong, on a window.

There is nothing remarkable in the discovery of so many new species of this family,—which owing to the small size and ordinary appearance of most of its members has been very litte collected.

CHIRONOMIDÆ.

In spite of Kieffer's work in this family, 'the fringe,' as Dr. Annandale has remarked, 'has merely been touched,' in regard to Indian forms. None have been hitherto recorded from the Khasia, though some Sylhet species have been described, and our knowledge is mainly confined to the Ganges Delta, with a certain number of species from Ceylon. Kieffer's work is extraordinarily difficult to follow, and personally I seldom feel sure of even generic definitions made thereby. Hence, one naturally pays less attention to members of this family than would otherwise be the case. For this reason even my Ceylon collections are less complete in this than in any other family, Cecidomyids not excepted. During the tour only seven species were obtained, which seem to belong as follows:—*Chironomus*, two species, both Shillong; (?) *Cardiocladius*, two species, one from Shillong, the other from Nongpoh, but both differing from an unnamed Ceylon species in my collection provisionally assigned to that genus by the immensely swollen and spined fore femora; *Procladius*, one species, Shillong. From pupæ in a rotten shoot of bamboo, which had died when a few inches above ground, at Shillong, three females of a *Forcipomyia* and four males of a (?) *Metriocnemus* were bred, emerging at Pusa in November, though they would probably have overwintered in the pupal stage if left at Shillong. Though both species are represented by specimens of a single, and opposite sex, there is at least no doubt that two species of very different genera are present. None of these species are represented in my Ceylon collections.

PSYCHODIDÆ.[1]

Yet another family entirely unknown from the Khasia, where they do not appear to be common, as only two species were captured.

Pericoma metatarsalis (Brun.) var. *khasiensis*, nov. In the description I have given reasons for considering these specimens at least a good variety of this western Himalayan species. They were abundant, running in circles in

the usual fashion, on broad leaves on a hedge at Mawphlang, which was the only occasion in which the family was at all in evidence. Only a few survived capture in sufficiently good state to pin, as owing to rain my net was not in a fit state for taking such delicate insects.

Pericoma sp. A single male from Shillong represents, apparently, a new species near *impunctata* (Brun.), but I do not like to describe in this family from unique sepcimens, as dissection is essential if structure is to be properly made out.

A small species, of which no specimens seem to have survived, was noted as attracted to freshly dropped cowdung at Shillong, and may possibly have been *Psychoda nigripennis* (Brun.), which breeds in this material. None the less, the apparent absence of this genus is interesting, as in Ceylon it is much more prevalent than *Pericoma*, being represented in my collections from the Island in the proportion of five to one, and recorded in Brunetti's recent catalogue in the proportion of four to one.

CULICIDÆ.

Though the mosquitoes of Assam are fairly well known, it would appear that serious collections have been made only in Sylhet and the Lushai Hills, for from the Khasia I have only been able to find a single species definitely recorded. A hurried collecting tour devoted to the order in general is not likely to furnish anything like a complete tally of the mosquitoes present even at the time of one's visit, but none the less the collection made proves a most interesting one, and has resulted in adding two species to the Indian list. The Malayan element in the fauna is, as might be expected, most marked. The collection was worked out at Kasauli by Major Christophers, C.I.E., I.M.S., to whom my best thanks are due. The most productive locality was the small wood, referred to previously, at Cherrapunji, and it is at this station alone that my diary notes mosquitoes troublesome at night. This, of course, refers to the Hills; mosquitoes at Gauhati made the night a purgatory only comparable, in my experience, to a bad mosquito night at Kanthalai, near Trincomali.

**Anopheles gigas.* (Giles) Dumpep, in dâk bungalow, at dusk. This is the only species heretofore recorded.

**Anopheles maculatus.* (Theo.) A gorged female in bedroom, after a very cold night on October 20th, Shillong.

Armigeres apicalis. (Theo.) In wood, Cherrapunji.

**Armigeres obturbans.* (Wlk.) One male, Shillong.

**Stegomyia trilineata.* (Leic.) Many specimens, in deep jungle at the mouth of Maosmai Cave, near Cherrapunji. It was noticed that they attacked

our Khasia guides much more than we suffered ourselves, which is contrary to what one would expect.

**Ochlerotatus ostentatio.* (Leic.) Cherrapunji. A Malayan species also recorded from Peradeniya.

Ochlerotatus pulchriventer. (Giles). Cherrapunji. Hitherto only known from Naini Tal.

**Ochlerotatus vexans.* (Meij.) Cherrapunji, Dumpep and Shillong, several specimens. The species apparently ranges from Canada to Fiji, but not into Africa.

**Culex mimeticus.* (Noë) Shillong and Cherrapunji. These specimens are the true *mimeticus*, and not the tropical *mimulus*, Edw.

**Culex tritæniorhynchus.* (Giles) A female from Shillong, in bedroom, and a male from Gauhati, in jungle, identified as this species by Major Christophers, do not appear to me to be conspecific with specimens identified as the same species from Ceylon, having the wing scales broader, and leaning more towards *sitiens*, Wied. Our knowledge of the very difficult group of *Culex* comprising those species with a banded proboscis is still insufficient.

Culex univittatus. (Theo.) One male, Shillong. This African species had previously been recorded from Singapore, and now comes on to the Indian list for the first time. Its occurrence in such a remote locality absolutely disproves any idea that it is a recent introduction to Asia by shipping, which the Singapore record would easily warrant.

**Culiciomyia viridiventer.* (Giles) Five males, resting in a flooded pit latrine at Laitlyngkot. I feel sure that there is a *mélange* of species under this name. Bred originally at Naini Tal in a waterfall, it is a far cry from such a habitat to a flooded latrine, or a water butt, from which I bred it in Ceylon. I cannot conceive of any single species with such diverse tastes.

**Tæniorhynchus brevicellulus.* (Theo.) Captured at Gauhati.

Tæniorhynchus ochraceus. (Theo.) A pair from Cherrapunji. This species was captured by Mrs. Bainbrigge Fletcher, who thus adds to our fauna one of the most beautiful species of the family, known previously only from Kuala Lumpur. This is one of the most interesting captures of the whole tour.

Mansonioides annulipes. (Wlk.) Taken at Burnihat and Gauhati. A Malayan species hitherto recorded in the Indian sub-region only from Calcutta.

**Mansonioides uniformis.* (Theo.) A female in jungle, Gauhati.

At neither Gauhati nor Burnihat did I notice any *Pistia stratiotes.*

**Aedes butleri.* (Theo.) Gauhati. A Malayan species recorded also from Colombo. Identified with a certain amount of doubt.

Uranotænia testacea. (Theo.) Three females in bed of stream in jungle, Gauhati. Hitherto known only from the Malayan sub-region, and recorded in our fauna only from the Dawnat Range, Tenasserim.

DIXIDÆ.

Dixa montana. (Brun.) A male taken on our last day in the hills, at the Crinoline Falls, Shillong, proves to belong to this species, previously known only from the Simla Hills, where it appears common.

BIBIONIDÆ.

Crapitula melanaspis. (Wd.) Shillong, Dumpep and Cherrapunji. Previously recorded from the Khasia. It was very common around heaps of old, rotted cowdung, in which it was breeding, mature larvæ and pupæ being found in the dung and in earth close by.

Plecia tergorata. (Rond.) Cherrapunji. Previously recorded from the Khasia.

Dilophus gratiosus. (Big.) Three specimens, from Shillong. Not previously recorded, though it occurs from the western Himalaya to Yunnan.

SIMULIIDÆ.

Simulium aureohirtum. (Brun.) A male of this widely, but erratically, distributed species, which was previously known from Umling in these hills, was taken at Shillong hovering before flowers of a cultivated composite.

Simulium metatarsale. (Brun.) A male from Shillong. Brunetti hardly sufficiently emphasizes the extraordinary development of the hind metatarsus of this species, which is so vastly in excess of the quite sufficiently remarkable incrassation of the joint in the other Indian species. Hitherto only known from the unique type from Kurseong.

TIPULIDÆ.

The Tipulidæ of the Khasia are better known than most other families, whilst most of the species collected by Dr. and Mrs. Kemp in the Garos, on the same range further to the west, bring to our knowledge species which will probably be found, ultimately, on the Khasia also. The Ceylon element in the fauna is very small, showing how local are these insects.

Ctenacroscelis dives. (Brun.) A male was taken on the first day's collecting at Shillong, and no further specimens were seen. It was apparently too late in the season for the occurrence of these giant forms. This species has hitherto only been known from the Darjiling District.

Tipula fumifasciata. (Brun.) Shillong and Laitlyngkot. A Chinese species, hitherto only recorded in our region from Manipur, this record extends its distribution a good deal further westwards.

Tipula himalayensis. (Brun.) Common at Shillong, taken also at Mawphlang and Dumpep. Previously recorded. The legs of my specimens are rather more yellow than the description indicates, and the preapical femoral yellow rings are indistinct, especially on the fore legs.

Tipula quadrinotata. (Brun.) A female from Cherrapunji. Known previously from Darjiling and Manipur, its occurrence on the intervening range was to be expected.

Tipula tenuipes. (Brun.) A single specimen from Shillong. Previously recorded from Sylhet only.

Tipula sp. Two females from Laitlyngkot apparently represent a new species near *tenuipes,* but are in too bad order to describe.

Pachyrrhina consimilis. (Brun.) Laitlyngkot and Cherrapunji. Distributed from Peshawar to the Khasia.

**Pachyrrhina javensis.* (Dol.) A pair from Shillong. A Malayan species also found in Ceylon. Previously recorded from the Khasia and the Garos.

Pachyrrhina serricornis. (Brun.) Shillong, Mawphlang, Laitlyngkot, Dumpep and Cherrapunji. Common everywhere. Occurs from Lahore to Yunnan, and possibly also in Japan.

Dicranomyia cuneiformis. (de Meij.) A male from Cherrapunji. Known previously from Java, North Kanara and Tenasserim.

Dicranomyia nitidithorax. (sp. nov.) The unique type from Shillong.

Dicranomyia pulchripennis. (Brun.) Shillong, two females previously recorded.

Dicranomyia sordida. (Brun.) Common, taken at Shillong, Cherrapunji, Dumpep and Laitlyngkot. Previously only recorded from the Darjiling District.

Geranomyia pulchripennis. (Brun.) Cherrapunji, known previously from Shillong.

**Geranomyia semistriata.* (Brun.) Four specimens, from Shillong, whence it has been previously recorded, as also from Cherrapunji by Kemp. Occurs at the four-thousand-foot level in Ceylon (Maskeliya).

Atarba flava. (Brun.) Cherrapunji. Hitherto only known from Darjiling where it is common in the autumn (Brunetti).

Molophilus inconspicuus. (Brun.) A specimen from Shillong, and another taken on grass at mile-post 25 on the Cherrapunji road, appear to be this species, which is known from the Himalaya and Travancore.

Erioptera grandior. (Brun.) Dumpep. Previously only recorded from Simla.

Acyphona indica. (sp. nov.) The unique type from Shillong. The genus occurs in the East in Java, but has not hitherto been found in the Indian sub-region.

**Gonomyia conjugens.* (sp. nov.) The types are from Shillong and Matale, in Ceylon, respectively.

Gnophomyia strenua. (Brun.) A single specimen from Shilliong supplements the unique type from Darjiling.

Gnophomyia sp.—A male from Cherrapunji lacks a head and is unidentifiable.

**Trentepohlia trentepohlii.* (Wd.) A female from Gauhati of this widely distributed species, which was not seen in the Hills.

**Conosia irrorata.* (Wd.) This widely distributed species has apparently not been recorded hitherto either from Ceylon or the Khasia, where a single specimen was taken at Shillong. In Ceylon it occurs, but rarely.

Amalopis novempunctata. (sp. nov.) The unique type of this very beautifully marked species was taken at Shillong.

Limnophila fletcheri. (sp. nov.) Several specimens of this new species, from Shillong and Cherrapunji.

Limnophila fusca. (Brun.) A male from Cherrapunji. Hitherto only known from Darjiling District.

Limnophila multipunctipennis. (sp. nov.) Two examples, Shillong.

Eriocera maculiventris. (Brun.) A female from Gauhati, resting on a tree in scrub jungle. Known only from the Garos, at a considerable elevation, hitherto.

Eriocera plumbolutea. (Edw.) A male, flying over a stream, Shillong. The unique type is also from the Khasia.

Eriocera semilimpida. (Brun.) Shillong, in marshy ground opposite the Convent. Apparently confined to the Khasia.

STRATIOMYIDÆ.

Ampsalis longispinus. (Brun.) A male of this beautiful Tenthredinid mimic flew into the verandah of a bungalow on a dull afternoon, Shillong. Previously recorded from Shillong and Darjiling District.

**Negritomyia maculipennis.* (Macq.) A female from Nongpoh of this species, which has hitherto been recorded only from Ceylon and Coorg in our region, though known also from the Philippines, Moluccas and Papua.

Ptecticus aurifer. (Wlk.) A male from pine forest, Shillong; the species extends from Masuri to Borneo. In flight is extremely pseudaposematic.

**Sargus mactans.* (Wlk.) Shillong and Gauhati, four examples. A somewhat widely distributed species. It might be noted that Howlett's figure in *Indian Insect Life* (Plate LXI, fig. 3), is of this species, and not *metallinus* F., as stated.

**Michrochrysa flaviventris.* (Wd.) A female from Burnihat, flying round a pond in heavy shade, belongs to this widely distributed species.

As was to be expected, the Stratiomyidæ collected represent the family but poorly. It is far more abundant in the Plains.

TABANIDÆ.

In spite of the large number of species recorded from the lower ranges of the Khasia northern face, Tabanidæ seem extraordinarily scarce on the Shillong plateau. No specimens were taken during the tour and none have previously been recorded, though I have seen one or two from Shillong in the Pusa collection of this family, which has not yet been worked out.

BOMBYLIIDÆ.

**Exoprosopa insulata.* (Wlk.) A female of this widely distributed species was taken flying slowly over grass on the last day of the tour at Shillong, probably just warmed out from the chill of the previous night.

Exoprosopa latipennis. (Brun.) Eight examples of this beautiful species, which is apparently confined to the Khasia, were taken hovering over a grass bank by the Survey Department offices at Shillong, on 8th October. The species was seen nowhere else and on no other occasion, and I understand that the Imperial Entomologist has taken it just here in previous years.

What was probably a *Systropus* was seen, and missed, at Dumpep, where the high wind that was blowing on the day of our visit made everything very wild.

THEREVIDÆ.

Thereva flavolineata. (Brun.) This handsome species, which seems to be entirely confined to the Khasia, is represented by a female from Laitlyngkot, taken flying round *Prunus nepalensis.*

ASILIDÆ.

It is as yet impossible to identify Indian species of this family, though Mr. Brunetti is at present engaged in working them out. Of the eleven species

taken, ten belong to the Asilinæ, and one to the Dasypogoninæ, the other two sub-families not being represented. Of the Asilinæ, four species belong to *Ommatius*, (*s. l.*) three to *Machimus*, two to *Neoitamus* or an allied genus, and one to *Philodicus*, being very near a Ceylon species of that genus belonging to the four-thousand-foot level, differing in the number of posterior dorso-central bristles only. One sp. of **Ommatius*, taken at Shillong, is actually conspecific with a Ceylon species occurring in the foot hills. One of the *Neoitamus* species was taken with prey, a Lymantriad moth, at Shillong, and was also taken at Nongpoh, which is a wide distribution in elevation. The family was most abundant, proportionally, at Dumpep, where possibly the grass land formation nourished an Orthopterous fauna yielding suitable prey. The high proportion of species belonging to *Ommatius* is noteworthy.

EMPIDÆ.

**Hybos apicis.* (Brun.) A male from Nongpoh belongs to this species, which, although only recorded from Tenasserim, is common at 1,300 feet in Ceylon.

Hybos bisetosus. (Bezzi.) Five males, from Shillong, appear to be this species, described from the Western Ghats at 2,600 feet, but the tomentum on the thoracic depression is brilliant gold, not grey, as stated. The tips of the hind femora are much more blackened than Brunetti's key (but not Bezzi's description) would lead one to expect, and the former author's *tenuipes*, concerning the validity of which he expresses a doubt, is probably good.

DOLICHOPODIDÆ.

I have postponed the working out of my entire collection in this family until the results of Becker's examination of the Zoological Survey's collection have been published. Of the eight species of the family taken during the tour four belong to *Psilopus*,—(*one common to Gauhati and Ceylon at all levels from 500 to 4,000 feet),—one common to Shillong and Gauhati, and the other two represented by a few specimens of apparently localized species found at Mawphlang and Gauhati respectively. The genus seems poorly represented on the Hills of North India as compared with Ceylon, where it is predominant, being even more scarce in Darjiling collections received from Mr. Shaw of the Govt. Cinchona Plantations, Mungpu. Of the remaining species, two belong to *Dolichopus*, one represented by a single Gauhti specimen, the other, which I know also from Mungpu, from Shillong and Dumpep. A **Diaphorus* from Gauhati occurs in Ceylon, and with a single specimen of a *Sympycnus* from Gauhati completes the tale of a family which

in any Ceylon collection made over the same period and elevation would be far more abundantly represented. As it is, the majority of the species came from Gauhati, and not the Hills proper.

PHORIDÆ.

Aphiochæta flavifacioides, sp. nov. The unique type, from Cherrapunji, represents the only specimen of the family obtained, but as special methods involving breeding are required for its adequate investigation, this is not to be wondered at.

PLATYPEZIDÆ.

**Platypeza argyrogyna.* (de Meij.) A long series from Shillong and Gauhati. The Shillong specimens are extremely large as compared with those taken in Ceylon, but the difference is more apparent in life than in the box. The Khasia form is *obscura* (Brun.), but at Gauhati the form with yellow first and second tarsal joints makes its appearance. Neither shows the white shimmer on the thorax to the extent Ceylon specimens do.

PIPUNCULIDÆ.

An undescribed *Pipunculus*, from Dumpep, represents this family. As in this, so in the two succeeding ones, the long delayed publication of Brunetti's third 'Fauna' volume on the Order has to be awaited for determinations to be made of any but the most well-known species.

SYRPHIDÆ.

This family is, undoubtedly, the most prominent feature of the fly fauna of the Khasia. To any one who, like myself, is only acquainted in the East with the sparse and unremarkable representatives of the family in South India and Ceylon, the abundance of handsome species comes as a revelation.

(?) *Paragus* sp. A pair from Shillong appear to belong to an undescribed species in this genus.

(?) *Pipiza* sp. A female from Shillong.

**Syrphus balteatus.* (de Geer.) As common here as elsewhere. Specimens from Shillong, Dumpep, Laitlyngkot and Cherrapunji.

Syrphus confrater. (Wd.) Two females from Cherrapunji appear to be this species, which is widely distributed in North India.

**Syrphus ericetorum.* (Fb.) Another widely distributed species, represented by a pair from Shillong and a male from Gauhati. The Shillong female was flying in company with *Exoprosopa latipennis.*

Syrphus spp. Two species, one represented by a female from Dumpep, the other, which I also have from Mungpu, by a pair from Shillong.

**Sphœrophoria javana.* (Wd.) Three males from Shillong.

Sphœrophoria nigritarsis. (Brun.) A pair from Shillong and two females from Dumpep are of this species.

Sphœrophoria viridœnea. (Brun.) A female from mile-post 25 on the road to Cherrapunji, amid grass downs.

**Sphœrophoria* sp. A very common Ceylon form, represented by two females from the marsh in front of the Convent, Shillong, I cannot identify with any of the described species. It seems to belong to an intermediate between Brunetti's 'forms 1 and 2.' I have seen the same species from Banhar, in North Bihar. In all these specimens the last two joints of the hind tarsi are dark, a character of which Brunetti makes no mention.

Sphœrophoria sp. A single female from Shillong, apparently represents yet another species, or form, in this genus, in which it is interesting to note that the common and widely distributed *scutellaris*, Fb., is not represented. Two species of the genera with pedunculated abdomen allied to *Baccha* occur, one from Shillong, Cherrapunji and Dumpep, the *other from Shillong only, but represented in my collection by specimens from various localities in Ceylon, and from Pusa.

(?) *Orthoneura* sp. Two males from Shillong, and two females from Cherrapunji apparently belong here.

(?) *Melanostoma* spp. Four species, one from Shillong only, *two from Cherrapunji in addition, the *fourth from both places and Mawphlang, apparently belong here. The three last mentioned are all found in Ceylon, and I have two of them from North Bihar also.

Rhingia sp. An undescribed species from Shillong and Cherrapunji, both females. At the latter place the specimen was hovering before the door of the Circuit House, and was taken for a Bombylid exploring the key hole.

Eristalis tenax. (L.) As common at Shillong as it appears to be at Darjiling. A male from Laitlyngkot.

Eristalis spp. Four species, which I cannot identify. *One of them I have also from Ceylon and Banhar, another, very common at Shillong, also from Darjiling. The other two are not represented from elsewhere in my collection.

Megaspis chrysopygus. (Wd.) A male, on flowers of a composite, in a garden, Shillong, was the only one seen. Being on a mere 'after tiffin' stroll neither of us had a net handy, and its capture by hand by the Imperial Entomologist was no mean feat! A wonderfully striking species.

Megaspis errans. (Fb.) A male from Shillong.

**Megaspis zonalis.* (Fb.) A female of this beautiful species from Shillong. It occurs, but rarely, in Ceylon also.

Eumerus spp. Two species of this genus from Shillong, but neither was at all common, or agrees with species from other localities in my collection.

CONOPIDÆ.

Physocephala sp. A male resting on a blade of grass in the swamp, Shillong, belongs to a species which I also have from Sukna, at the foot of the Darjiling Himalaya, and is the only specimen of the family collected during the tour.

ACALYPTRATA.

Our knowledge of the Indian families in this sub-order is more than incomplete—it may be said to be non-existent. Here and there a genus, and one family, the Trypetidæ, have been worked out, but until India obtains the services of another Brunetti to blast a track through the jungle of forms, obfuscated as it is by the misdirected efforts of Walker and Bigot, but little progress can be expected. The work cannot be done in India. In the Nematocera we are dealing with families most of whose species are of fair size and possess noticeable separatory characters, probably also a somewhat restricted distribution, but here we reach a mass of obscure and small species which are often either of wide distribution or closely allied, and the described species of which are in all probability entirely wrongly allocated as to genera. As a pre-requisite to further study, the elucidation of the types of the heretofore described species is essential, and this can only be done in Europe. A prominent species, here and there, may be safely identified from literature, the remaining descriptions only represent an inchoate mass. It is peculiar that, so far as my experience goes, jungle country is much less productive of species than is cultivated, but this may really be due only to their normally small size rendering them inconspicuous and overlooked in wild surroundings. In the present collection not very many species were obtained, and all I can attempt, save in Trypetidæ, in which Bezzi's working out of the Zoological Survey's collection forms a ground work, is to indicate such Ceylon affinities as I have found. It is useless to run any particular species down to a modern genus and, finding that genus unrepresented in the East, to thereupon describe the species as new, Walker has probably, already described it several times and allocated his various synonyms to some totally unlikely genus, probably that from which the family takes its name. I write from my experience in working out the Muscidæ in collaboration with Major Patton, I.M.S., and there is no reason

to suppose that Walker was any more careful in Acalyptrata than in the higher Muscoids.

BORBORIDÆ.

Represented by a single species from Laitlyngkot and Mawphlang.

CHLOROPIDÆ.

Seven species, one common.

EPHYDRIDÆ.

Two species, apparently belonging to *Notiphila*, are represented by single specimens from Laitlyngkot and Dumpep respectively. A *third species, belonging to a genus not included in 'Williston' ; is found in Ceylon and at Cherrapunji.

DROSOPHILIDÆ.

A (?) **Leucophenga* sp. I have from Shillong, Mungpoo and Ceylon, and of a species of **Stegana*, which I have bred from beneath decaying *Hevea* bark in Ceylon, I obtained a single specimen at Cherrapunji. Five other species were taken *one of which also occurs in Ceylon.

AGROMYZIDÆ.

Three species, *one of which is also found in Ceylon.

SEPSIDÆ.

Of the three species obtained,* two are also known to me from Ceylon.

MICROPEZIDÆ.

* *Texara dioctrioides.* (Wlk.) A single specimen from Mawphlang ; the species is not uncommon in Ceylon, and was originally described from Celebes. It is probably a Braconid mimic.

Calobata spp. Two closely allied species which mimic an Ichneumonid of the *Lissonata* group. The Shillong species, with black antennæ, I have not seen from elsewhere ; *the Gauhati species, with yellow antennæ, is common in Ceylon. These are the most wonderful mimics known to me ; the use of the front legs to imitate the vibrating, white-ringed antennæ of the hymenopteron is marvellous.

ORTALIDÆ.

**Stenopterina cænea.* (Wd.) A pair from Nongpoh of this common scatophilous species, which apparently does not ascend the hills further, although I have it from 4,000 feet in Ceylon.

No other species of this very large family were taken. It is apparently as poorly represented here as it is in Ceylon, from which, after years of collecting, I only possess ten species.

DIOPSIDÆ.

Teleopsis spp. Three species, one from Cherrapunji, two from Gauhati, are so closely allied that they may possibly be only forms of a single variable species. All are represented by single specimens, and I have seen nothing like them from elsewhere.

SAPROMYZIDÆ.

Thirteen species, of which *five are also found in Ceylon. One of these is from Gauhati, one, (a *Lonchæa*), common to Gauhati, Shillong and N. Bihar, the others from Shillong and Cherrapunji. Another Gauhati species is also found at Pusa. Of the remainder, six belong to the higher levels, one to the Plains at Gauhati.

TRYPETIDÆ.

**Chætodacus caudatus*. (Fb.) A single specimen of this widely distributed species from Shillong.

Chætodacus scutellaris. (Bezzi.) Two females from Shillong, whence the species has already been recorded. Occurs from Almora to the Shan States.

Chætodacus scutellarius. (Bezzi.) Two females from Shillong belong to this species, hitherto only known from Mysore.

Tæniostola vittigera. (Bezzi.) Two pairs, resting on the underside of leaves in the bed of a stream overhung with jungle, Gauhati. This beautiful species is apparently confined to Assam.

Rioxa vaga. (Wd.) A female taken in company with the previous species appears to be this, though in some respects the wing agrees with Walker's description of his *mutyca*, possibly the two are but varieties of a single species. The latter is recorded from Sadiya, at the head of the Brahmaputra Valley.

Elaphromyia pterocallæformis. (Bezzi.) A single specimen from Cherrapunji of this species, hitherto known only from the Western Himalaya. It mimics a homopterous insect.

Tephritis tribulicola. (sp. nov.) Breeds in the gigantic thistle which is one of the features of the Shillong flora. Specimens from there and Mawphlang. The thistle seems to be confined to the same country as *Pinus khasiana*, hence the non-appearance of the fly at Cherrapunji and Dumpep.

It will thus be seen that, in the only Acalyptrate family in which accurate determination is possible, only one widely distributed species is common to the Khasia and Ceylon. That the known distribution very imperfectly represents

the actual facts is shown by the breeding from flower heads of *Gonicaulon glabrum* at Nagpur of *Craspedoxantha octopunctata*, (Bezzi.), a species hitherto confined to its unique type from Tenasserim, a district about as remote in character from the Central Provinces as any other in the Empire. More careful collecting will probably reveal many other species besides those which are pests of cultivated plants to be of wide distribution.

ANTHOMYIDÆ.

This is the most impossible family of all the sub-order, the very English species are only now being cleared up, and individual species are known to be of extraordinarily wide distribution. Twenty-six species were taken on the tour. Of them, a **Lispa* is common to Ceylon, Mungpu and Shillong, another *species, of undetermined genus, I have from Ceylon, Pusa and Shillong; *another from Ceylon at 4,000 feet, Burnihat, Laitlyngkot and Dumpep, also from Coonoor; *another from the low country of Ceylon, Gauhati and Cherrapunji. Of the remaining species twenty are from high levels, two of them occurring at about equal elevations on the Nilgiris, and two from the Plains.

CALYPTRATA.

Muscidæ.

The Indian species of this family are now undergoing revision and elucidation by Major Patton, I.M.S., and myself, and this work is still far from complete. It is not possible, therefore, to name everything taken on the tour, or to guarantee that the name given a species in these notes will not be supplanted later on by the discovery of an older one, but the majority of the species have been identified with some description. The distribution in the family is so wide that the absence of the commoner species from any station is of greater interest than their presence, denoting the operation of some as yet uncomprehended factor for that species. For example, a special search was made on the Khasia for *Musca cingalaisina* (Bigot), (*Philæmatomyia indica*, Awati), without result, and although the species is known from as far North as Delhi it apparently fails to reach the Khasia, much more closely allied though this is to Ceylon than is the Gangetic Plain.

All determinations, except in Rhiniinæ, have been gone over by Major Patton.

**Musca nebulo.* (Fb.) The common housefly at Shillong, Mawphlang, Laitlyngkot and Cherrapunji. Its replacement in this office at Gauhati by the next species is of peculiar interest.

Musca sp. *incert.* (P. & C.) This species, which still lacks[1] an exact determination, was the common fly in the Gauhati bazaar on the date of our visit. This is unusual, as the species does not commonly function as a house-fly.

**Musca humilis.* (Wd.) Shillong, Nongpoh and Gauhati.

**Musca ventrosa.* (Wd.) A single male from Nongpoh. Searched for in vain at Shillong.

Musca (?) *setigera* (Awati). (*convexifrons* P. & C., *nec* Thoms.) A single male from Mawphlang of this interesting species, the name of which is still in doubt.[2]

**Musca gibsoni.* (P. & C.) Shillong, Mawphlang, Dumpep, Cherrapunji and Nongpoh. Usually more or less confined to the Hills in India, although it reaches sea level in Ceylon.

**Musca pattoni.* (Aust.) Shillong, common. A pair from Nongpoh.

**Musca bezzii.* (P. & C.) Shillong, Laitlyngkot and Cherrapunji. Common.

**Musca lineata.* (Brun.) A single female from Shillong.

**Musca crassirostris.* (Stein) Cherrapunji, Nongpoh and Gauhati.

Pyrellia sp. A large larviparous species from Gauhati, Shillong, Mawphlang, Laitlyngkot and Cherrapunji. Occurs also in the Darjiling District.

**Pseudopyrellia* (?) *lauta.* (Wd.) Cherrapunji, Nongpoh and Gauhati. Another very common species which is absent from Shillong and the higher levels.

**Bdellolarynx sanguinolentus.* (Aust.) Three specimens from Shillong.

**Stomoxys bengalensis.* (Pic.) A single specimen from Shillong appears to be this species.

**Stomoxys calcitrans.* (L.) Everywhere along the road from Gauhati to Cherrapunji.

**Lyperosia exigua.* (de Meij.) A male from Gauhati belongs to this widely distributed species, which was not found in the Hills.

Calliphora aucta. (Wlk.) Described by Walker as a '*Musca*,' this species has never heretofore been recorded from any certain locality. One specimen, at food, Dumpep. It is larviparous.

**Chrysomyia megacephala.* (Fb.) Cherrapunji, Nongpoh and Gauhati. Not seen at Shillong although naturally a species which, if present, intrudes itself.

Chrysomyia pinguis. (Wlk.) Several specimens from Shillong. Occurs also on the Nilgiris.

Chrysomyia putoria. (Wd.) A pair from Shillong.

[1]Since described by Patton (*Ind. Journ. Med. Res.* X 71-73 ; July 1922) as *Musca incerta* ; but, as that name is an absolute homonym of *Musca incerta*, Walker (1856), this fly is still without a valid name.—T. B. F.

[2] According to Patton, this is *M. albomaculata*, Macq.—T. B. F.

Lucilia inducta. (Wlk.) One of Walker's 'green and gold' *Muscas*! Common at Shillong, one specimen from Laitlyngkot. Occurs in the Eastern Himalaya and the Nilgiris.

**Lucilia* sp. An unidentified species, larviparous in human excrement, was obtained at Gauhati. I know it from up to 1,300 feet in Ceylon, and it has been taken at the foot of the Nilgiris. It apparently does not attain a high elevation.

**Borbororhinia pubescens.* (Towns.) The first female to come to hand was taken by the Imperial Entomologist on a flowering tree in the Club compound, Shillong. Described from Cochin, it is not very rare in Ceylon. This is the first record outside the Ceylonese Province.

**Chloroidia flavifrons.* (Towns.) A single specimen of this, the most beautiful of Indian Muscidæ, was seen, and lost, at Shillong. Fairly common at times in Ceylon. Described from Mergui and Cochin, it is probably a Malayan species entering the Empire at the two ends which have affinities with that sub-region.

Idiella euidielloides. (sp. nov.) Types and another specimen from Shillong, the former taken on a flowering tree by the Imperial Entomologist.

Euidiella quadrinotata. (Big.) Four specimens from Shillong and Dumpep appear to be this Bornean species, which I have also from Mungpu. The basal pair of yellow abdominal spots is obsolescent.

It is interesting that among the wealth of species in this sub-family obtained at flowers in Shillong, the commonest of all, *Euidiella discolor* F., was not obtained.

**Strongyloneura nepalana.* (Towns.) A male from Shillong. This widely distributed North Indian species is common in Ceylon.

Strongyloneura viridana. (Towns.) A pair from Shillong. Known also from Calcutta and Sadiya.

Synamphoneura cuprina. (Big.) A pair from Gauhati appear to be this Malayan species, which I have also from North Bihar. Previously recorded from Assam.

Pollenia sp. Four females from Shillong, two taken sucking Aphid honey-dew, apparently represent a new species near *rudis*, but I refrain from describing them at present.

Polleniopsis (?) *pilosa.* (Towns.) Four specimens of what I take to be this species, but Townsend's specific description is so inadequate that consultation of his type is necessary, and this is not possible at present. The type is a male and these specimens are all females and differ by the legs being black, and in other minor points.

A *Bengalia* was seen, but lost,—through a hole in the net. The numerous burrs which the Shillong flora produces are not conducive to undamaged nets ; in spite of repairs I used four in the three weeks !

SARCOPHAGIDÆ.

Another family in which type elucidation is essential to any progress. With fourteen species of Walker's, two of Desvoidy's and three of Macquart's (to say nothing of others by workers less reckless in description), which require homologizing, nothing more can be said about the two species of *Sarcophaga* obtained than that *one is as common in Ceylon as at Shillong and Cherrapunji, and the other species, also from the same Khasia localities, is represented in my collection by that great desideratum in this genus, a pair *in cop.* from Pusa.

DEXIIDÆ.

Of the eight species taken, *two are common to the Khasia and Ceylon. One of these, (?) *Prosena* sp., occurs from sea level to 4,000 feet in Ceylon, and at Shillong and Cherrapunji, where it abounded. It is very fond of resting on pine trunks at Shillong. Of the remaining species, five are from Shillong and the higher elevations, one from Gauhati. One of the former is a wonderful hymenopterous mimic in black and yellow, and was taken flying slowly, which is most unusual in this family, over a stream near the Fruit Farm at Shillong. Slow flight is a sure sign of effective protection.

TACHINIDÆ.

Unless a worker who is capable of comprehending the writings of Brauer and von Bergenstamm and of Townsend can be found to devote his whole time to the Indian species of the family I fear that the present generation of entomologists will see but little progress made in our knowledge of these important parasites. It is a matter of extreme difficulty, save in the case of a few well-marked species, to decide whether any two specimens are, or are not, conspecific. My captures appear to belong to twenty species, only one of which, a beautiful yellow *Bombyliomyia* from Laitlyngkot amid long grass, I can with any certainty refer to even a genus, and to conspecificness with numerous other specimens from Mungpu at various elevations between two and five thousand feet. The other species are represented by one to three specimens each, mainly from localities of equal elevation, but one species was taken at Shillong and Nongpoh. The single species from Gauhati was not seen higher up. One Shillong species, with black thorax and wings and flattened, orange abdomen, is in flight a Reduviid mimic. None of the species have any affinity with those known to me from Ceylon, or, with the exception quoted, from the Eastern Himalaya.

PUPIPARA.

The common *Hippobosca maculata* (Lch.) was not seen anywhere, which is most surprising.

No shooting of bats was done, and so the *Nycteribiid fauna* is unrepresented.

The captures in each family are summarized below. It will be seen that the proportion of species occurring common to the faunas of the Khasia and Ceylon is approximately the same for each of the five (out of the six), great divisions of the Order which were obtained. The community of type thus indicated is fairly high, and may be said to confirm the impression which the tour was designed to verify; but, until the Palnis, Nilgiris and Chota-Nagpur Hills have been subjected to similar investigation, whether this similarity is one of station or of region, must remain in doubt.

It is greatly to be hoped that these localities may be similarly explored.

Family	No. of spp. captured	No. of spp. also known from Ceylon	Percentage of spp. common to both areas
Cecidomyidæ	1	..	..
Mycetophilidæ	16	3	19
Chironomidæ	7	..	..
Psychodidæ	2	..	..
Culicidæ	18	12	75
Dixidæ	1	..	..
Bibionidæ	3	..	..
Simuliidæ	2	..	..
Tipulidæ	31	5	16
NEMATOCERA	81	20	24
Stratiomyidæ	5	3	60
Bombyliidæ	2	1	50
Therevidæ	1	..	..
Asilidæ	11	1	9
Empidæ	2	1	50
Dolichopodidæ	8	2	25
Phoridæ	1	..	..
BRACHYCERA	30	8	27
Platypezidæ	1	1	100
Pipunculidæ	1	..	..
Syrphidæ	28	8	28
Conopidæ	1	..	..
ASCHIZA	31	9	29

Family	No. of spp. captured	No. of spp. also known from Ceylon	Percentage of spp. common to both areas
Borboridæ	1	..	..
Chloropidæ	7	..	..
Ephydridæ	3	1	33
Drosophilidæ	7	3	43
Agromyzidæ	3	1	33
Sepsidæ	3	2	67
Micropezidæ	3	2	67
Ortalidæ	1	1	100
Diopsidæ	3	..	..
Sapromyzidæ	13	5	38
Trypetidæ	7	1	14
Anthomyidæ	26	4	15
ACALYPTRATA	77	20	26
Muscidæ	32	18	56
Sarcophagidæ	2	1	50
Dexiidæ	8	2	25
Tachinidæ	20	..	..
CALYPTRATA	62	23	37
THE ORDER	281	80	28

2. NOTES ON THE TABANIDÆ IN THE COLLECTION OF THE FOREST ZOOLOGIST.

I have recently received for study from Mr. C. F. C. Beeson, Forest Zoologist, a collection of about ninety specimens in this family, collected by Dr. Cameron, Mr. S. N. Chatterjee and himself, mainly in the Western Himalaya and Burma, but including a few specimens from other localities. Both the Western Himalaya and Burma are notorious for Surra, and in view of the importance of an accurate knowledge of the distribution of species in this family for correlation with the distribution of the disease, the etiology of which is, as regards the transmitting agent, still obscure, the collection is of great value. Practically nothing is known of the Tabanidæ of Upper Burma, where the disease is so rife that, according to Captain Enriquez, the trade route to Yunnan is closed for several months of the year, through the Chinese muleteers refusing to expose their animals to its ravages, while the remoteness and difficulty of access of the locality is such that material is almost impossible to come by in the ordinary course. Hence the thanks of the Agricultural Department are due to Mr. Beeson and his Staff, whose tours take them into localities seldom visited by officers of the Agricultural Service,

for material which otherwise there would be considerable difficulty in obtaining.

The material forming the collection has been returned to the Forest Zoologist's collection at Dehra Dun. The various new species discovered are described in another part of this Memoir.

Tabanus excelsus. (Ric.) Ten females from Muthrwala, Dehra Dun, on 30th and 31st October 1919, and one female from Masuri on 18th June 1920. This species was described from 'a long series in bad condition.' In the present specimens the following points at variance with the description are to be noted :—the tarsi are darker than the tibiæ, which may be almost whitish, not yellow ; the median triangular abdominal spots are almost linear. In many specimens the two calli are joined by an obvious line, often nearly as broad as the upper callus, making rubbed specimens very misleading. This is probably figure 13 of Plate IV of Leese's paper on Tabanidæ taken at Mohand. Previously only recorded from Mashobra, Simla District.

Tabanus leucocnematus. (Big.) One female from Mohnyin Reserve, Katha, Upper Burma, at light, on 19th May 1919. Previously only known from the Khasia and Lushai Hills in Assam. I have a female in my own collection from Mungpu, Darjiling District, taken on 19th May 1920. Its capture on the same date in two successive years in localities so far apart probably indicate that it is a Spring species, and is really found along the Eastern Himalaya and the Assam Hills to those of the Yunnan Frontier. Miss Ricardo's wording of her key in this group is misleading ; the apices of the front tibiæ are black.

Tabanus sexcinctus. (Ric.) This species, previously known from the Lushai Hills and Formosa, is represented by two pairs from Masuri, the dates ranging from 21st May to 29th June 1920.

Tabanus kakhyenensis, sp. nov. Three females from Mohnyin Reserve, 15th to 19th May 1919. A pair from Pyonchaung, North Toungoo, on the 22nd of the corresponding month, and two females from Yanaungmyin, Pyinmana, on 3rd and 9th June 1918, indicate that this also is a pre-Monsoon species.

Tabanus auriflamma. (Wlk.) Two females of this magnificent species from Nambor Reserve, Sibsagar, Assam, on 15th May 1921, a locality from which it has previously been recorded. Extremely pseudaposematic in appearance.

Tabanus sp. nov. From the same locality on the same date, Mr. Beeson sends a new species in Group VI, belonging to the same section as the last, with the first posterior cell open, which I refrain from describing until further material is available, as I am not certain to what extent the specimen before me is rubbed.

Tabanus striatus. (Fb.) A female of this widely distributed species from the Sunderbans, 24th February 1915, and what is probably the male of this species from Dehra Dun on 15th August 1919. The males of *rubidus*, Wd., *albimedius*, Wlk., and *striatus*, Fb. are so similar that separation on ordinary characters is uncertain, and no examination of the genitalia appears to have been made.

Tabanus albimedius. (Wlk.) A male from Masuri, in June 1920, I refer with some doubt to this equally widely distributed species.

Tabanus hirtistriatus. (Ric.) Three females from Mohyin, on 18th May 1919, are probably this Malayan species. They differ from the description as follows :—frons much less narrowed anteriorly, almost parallel ; the extension of the callus sometimes reaching the vertex ; the palpi practically without black pubescence, and the first two antennal joints with only a trace of such ; the front tibiæ are only yellow basally, and, in one specimen, the posterior tibiæ are only black at the apex. The abdomen is more yellow than the description would indicate. The specimens would agree better with the description of the series of males from the Dawnat Range, Tenasserim, doubtfully referred to this species by Miss Ricardo, and possibly two very closely allied species are involved, one of which still lacks a name.

Tabanus sp. near *hirtistriatus.* Two females from Bendaung apparently represent a new species near the above. They are very much larger. With only literature to guide me I refrain from describing them.

Tabanus monotœniatus. (Big.) Six females from Mohnyin, on 18th and 19th May 1919. This record joins up the two previously recorded localities of the North Khasia and Yunnan. Two specimens are of the blackish, and the others of the reddish, brown-abdomened variety.

Tabanus brunnipennis. (Ric.) Three females, from Mohnyin, on 19th May 1919. This is a very distinct species, and its extraordinary recorded distribution, North Kanara, North Bihar and Bangkok would indicate, with the present record, that it is a Malayan species, and on the Western Ghats represents the Malayan element visible in South India and Ceylon.

Tabanus auristriatus. (Ric.) Two females from Mohnyin, on 19th to 24th May 1919, I refer, with a doubt, to this species. One specimen has the antennal teeth prominent and only the apical ring of the third joint black. The frons is slightly narrowed. Previously only known from North Kanara.

Tabanus jucundus. (Wlk.) A female from Masuri, in July 1920. The extension of the callus is clavate at the tip. Previously recorded from this locality.

Tabanus rubicundus. (Macq.) Two females from Petsut, Katha, on 15th and 21st June 1921. Recorded previously from Assam and Java. I am

not sure whether there are not two species mixed up under this name. Comparing these specimens with one from Ceylon in my own collection, these have the antennal teeth much more pronounced and a very long appendix at fork of the third vein. If the relationship of appendix and strong teeth proves constant over a series, the type of Bigot's *monilifer*, sunk here by Miss Ricardo, should be examined for the latter character, and, if present, the name resurrected for such specimens.

Tabanus fuscomaculatus. (Ric.) Five females, from Masuri on various dates in June 1920, and a very large female from Kumaon, June 1914. Previously recorded from Myitkyina and Sikkim, the range of this species is thus extended far to the westward. These specimens present the following differences from the description :—antennæ red, only the apical ring of the third joint black ; the last four abdominal segments black and all finely pale margined, (Miss Ricardo states that the species has the antennæ black all over the third joint, whilst her subspecies, *altermaculatus*, from Manipur, has the antennæ all red) ; the tips of femora and tibiæ are yellow, but the tarsi are distinctly black except for the reddish under fringe. The black spot on the third segment may be lost in a general darkening of that segment. The species is probably variable and *altermaculatus* is possibly not a valid subspecies but only an extreme variation.

Tabanus oxyceratus. (Big.) From Masuri, a male on 17th May 1920, and two females in June of the same year. Previously recorded from this locality.

Tabanus sp. near *oxyceratus.* A female from Bangar, Chakrata, U. P., at 6,000 feet on 1st May 1921, belongs to a species not included in the Oriental fauna. The antennæ are all black and the abdominal segmental rings yellowish without a trace of spots, the scutellum is not whitish. This locality is far within the Western Himalaya, and has produced other Palæarctic species, such as *Chorisops tibialis*, Mg. (Stratiomyidæ, a specimen of which is included in the collection before me), and it will be necessary to compare this species with Central Asian ones belonging to the Palæarctic fauna before deciding whether it is new.

Tabanus orientis. (Wlk.) Three females from Mohnyin, on 16th May 1919. Known from Dungagalli to Yunnan, this is the first Burmese record for the species.

Tabanus fuscicauda. (Big.) One female from Okkyi, Shwegu, on 27th May 1919. Previously known from Ceylon, Sumatra and the Andamans. The Burmese agrees with Sumatran specimens in that the black mark on the second abdominal segment is absent.

Hæmatopota striatipennis. (Brun.) A male from Dehra Dun on 17th January 1910. This is the type locality and the species is not known from elsewhere. It is most extraordinary that the female has never been found, and it may be quite unlike the male, as in some African species. Brunetti states that the species falls in Group II, with the base of the front tibiæ whitish, but in the specimen before me the legs are all brown, bringing it into Group I. This mode of grouping, however, does not work with males, for the male of *javana*, Wd., has the legs all yellow in many specimens.

Hæmatopota beesoni sp. nov. One female,' on wing,' 11th May 1918, two females taken biting elephants 17th May 1918, all at Bondaung.

Hæmatopota javana. (Wd.) A male from Dehra Dun, in July 1913; a female from Kaiang Reserve, Pyinmana, 4th May 1919, a female from Bendaung, at light, 12th May 1918; and nine females, biting elephants, at the same place, on 17th May 1918. A widely distributed species, not hitherto recorded from Burma. The species seems not uncommonly to come to light; I have recently received one male and four females thus obtained at Banhar in North Bihar, in July and August 1921, from Mr. H. A. Inglis.

Hæmatopota fuscifrons. (Aust.) Three females, Mohnyin, 15th to 23rd May 1919. One specimen has the mid tibial middle ring absent. Not previously known from Burma. Recorded hitherto from ' India ' and ' Bengal.'

Hæmatopota burmanica sp. nov. Two females from Bendaung on 17th May 1918. Biting elephants.

Hæmatopota sp. nov. A small species from the same place as the last, on 11th May 1918, apparently represents a new species in Group VI F, but as it is unique I refrain from describing it.

Chrysops dispar. (Fb.) One female from the Upper Dihing, Lakimpur District, is an exceptionally large example of this widely distributed species.

Chrysops flavocincta. (Ric.) One female, Mohnyin, 23rd May 1919, A Malayan species recorded in our region from the Khasia, Ceylon and Travancore.

Much less attention has been paid to *Hæmatopota* than to *Tabanus* in regard to Surra transmission, but it is significant that no less than three species of the former genus, and none of the latter, are recorded as biting elephants which are said to suffer from the disease.

3. NEW SPECIES OF DIPTERA FROM THE INDIAN REGION.

CECIDOMYIDÆ.

ASPHONDYLIA OSBECKIÆ, sp. nov. (Plate XV, fig. 1.)

♀. *Head* grey, vertex with long yellowish hairs, Antennæ about as long as the thorax, brown, 2+12 jointed. Scapal joints short, sub-globular, flagellum

with first joint the longest, the next seven subequal, though each is very slightly shorter than the preceding one, about three times as long as broad; ninth about one and a half times as long as broad, tenth as long as broad, eleventh half as long as broad, twelfth very flattened ovate, wider than long. Hairs on basal half of each joint yellowish brown, about as long as the joint itself, on apical half much shorter. The two 'filets' on each flagellar joint as illustrated by Kieffer for his *Parasphondylia* on Plate XII, fig. 3 of fascicle 152 of '*Genera Insectorum*,' save that the lower 'filet' is situated at two-thirds instead of half the length of the joint, the connecting bar being correspondingly shortened. Palpi pale yellow, the palpiger minute, globular, first and second joints sub-equal, elongate, apical half as long again.

Thorax: dorsum shining black with the submedian lines thickly golden-brown haired; shoulders, seen from above, pale yellow. Pleuræ blackish, except pro-and ptero-pleura, which are yellowish. Dorsopleural suture with strong hairs in front of wing roots. Scutellum yellow, metanotum dark. Submedian hairs continued across the scutellum.

Abdomen with basal segment pale yellowish, remainder dark brownish with thick, rather paler, hairs. Ovipositor as long as the body, two-jointed, the second joint at right angles to the first, and twice its length, the needle-like terebra as long as both together. Basal joint with fine longitudinal striations, apical with very short erect pile, slightly longer on distal half. The whole ovipositor brownish yellow.

Legs dark brownish black, coxæ and trochanters a little paler. Pulvilli as long as ungues.

Wings greyish, thickly haired. Halteres with basal half of stem yellow apical half and capitellum black.

Long (without ovipositor) 1·25 mm.

Described from a ♀ taken on Osbeckia flowers, Shillong, 5th October 1920.

Type, partially dissected, in my own collection.

A true *Asphondylia*, unless the palpiger be admitted as a joint, in which case it falls into Kieffer's *Parasphondylia*, if this be admitted a valid genus, which I am inclined to doubt.

MYCETOPHILIDÆ.

Sciara brunniventris, sp. nov.

♀. *Head* black, vertex and face with greyish shimmer. Occiput with short black hairs, a fan of stiff bristles over mouthparts. Antennæ blackish, scapal joints shorter and broader than the flagellar, subequal, the tip of the

second white. Flagellar joints subequal, the first about three and a half times as long as wide, all with pale pubescence. Extreme base of first joint paler. Palpi three jointed, the first joint slightly thickened basally, as long as the second, the third nearly as long as both together, with an apical stiff hair stronger than the other soft hairs of the organ. Eyes bare.

Thorax blackish, shining, sides concolorous. Dorsal margins showing white viewed from above owing to minute grey dusting only visible in certain lights. Median and dorso-central rows of black bristles, the median ending in line with the wing roots, the exterior rows reaching the posterior margin, and becoming stronger posteriorly. Lateral margins in front of wing roots and postalar calli with strong bristles, the concolorous scutellum with some short hairs on the disc towards the hind margin as well as around the margin itself, which bears also two apical much longer bristly hairs.

Abdomen uniformly yellowish brown, the posterior margin of the fourth to seventh segments dorsally and laterally (but not ventrally), blackened to an increasing width, so that only the extreme base of the seventh shows paler. Eighth segment and the two-jointed lamellæ of the ovipositor black.

Legs: fore coxæ pale brown, posterior coxæ dark brownish. All femora pale brown, tibiæ slightly and tarsi rather more darkened. Tibial spurs yellow.

Wings pale hyaline grey, veins brownish. Auxiliary vein hardly reaching the origin of the third, which occurs at one quarter the length of the wing; anterior cross-vein and basal section of fourth vein of equal length. First vein ending slightly beyond the fork of the fourth, of which the petiole and branches are equal. Second posterior cell four and a half times as long as broad. Fifth vein forking near base, the branches diverging suddenly at half length; sixth vein stopping half way to wing margin. Halteres dark.

Long 4 mm.

Described from a unique female in good condition, taken at Cherrapunji, Khasia Hills, on 18th October 1920. In my own collection.

Easily separates from the other species in couplet 8 of Brunetti's table of Indian species on the yellow femora.

Sciara fletcheræ, sp. nov.

♀ *Head* black, vertex and face with soft hairs, the latter also with greyish shimmer in certain lights. Eyes markedly pale pubescent. Antennæ; scapal joints very dark brownish, the second shorter than the first, flattened spheroidal; scape slightly paler brown with pale pubescence, first thirteen joints subequal, the basal three times as long as wide, apical joint half as long again as the penultimate. Palpi black, three-jointed, the basal joint incrassate, acuminate,

the second thin, the third slightly broader than the second, with the tip elongate mammiliform; all joints subequal. Proboscis black.

Thorax: dorsum and pleura black, somewhat shining, humeri and propleura yellow-brown, the dorsum with only scattered black pubescence, stronger hairs laterally in front of wing roots and on postalar calli. Scutellum concolorous with several transverse depressions, and an apical fringe of soft black hairs.

Abdomen: dorsum and venter black; laterally a broad, uninterrupted primrose yellow stripe (fading in drying to mustard yellow). Ovipositor with the usual black lamellæ.

Legs: coxæ and trochanters black, fore femora yellowish brown, posterior pairs brownish black, all tibiæ and tarsi concolorous, the tibial spurs yellow.

Wings dark greyish black, veins hardly darker. Auxiliary vein long, extending distad of origin of third vein, which arises at one-third length of wing. First vein ending beyond fork of fourth vein, of which the petiole and branches are subequal, the second posterior cell four and a half times as long as broad. Fifth vein forking near base of wing, the branches sharply diverging at half length, sixth vein rather long but not reaching wing margin. Halteres with yellowish stem and dark capitella.

Long 4·5 mm.

Described from a unique female in good condition, taken in grass land along the river bank, Laitlyngkot, Khasia Hills, on 16th October 1920. In my own collection. The specimen fell to the net of the Imperial Entomologist, and I have much pleasure in dedicating the species to Mrs. Bainbrigge Fletcher, who, like her husband, was good enough to turn over to me all her dipterous captures throughout the tour, thus adding largely to the number of species obtained. The yellow fore femora separate this species at once from the others in couplet 9 of Brunetti's Indian table.

Sciara hirtilineatoides, sp. nov.

♀. *Head* black, face somewhat knobbed. Antennæ black, the first flagellar joint slightly longer than the others, which are subequal, all with minute pale pubescence. Palpi black, first joint rather longer than either of the others, which are subequal.

Thorax black, marked as in *hirtilineata* (Brunetti), with four grey stripes, the three dividing black lines bearing, however, very much shorter and sparcer pale hairs. Shoulders not paler, concolorous. Scutellum absolutely bare of marginal hairs, the dorsal margins of the thorax similar.

Abdomen black, with sparce pale hairs on dorsum, sides and venter pale brown. Female genitalia not elongate.

Legs black, the fore and hind femora show brownish in certain lights. Tibial spurs all black.

Wings black, venation as in *hirtilineata*, but the second posterior cell is quite four times as long as broad. The length of the wings to that of the body is also greater than in Brunetti's species. Halteres blackish.

Long 2·75 mm. Wings 5 mm.

Described from 2 females type in perfect condition, co-type with antennæ broken, both taken at Shillong, on 13th October 1920. In my own collection.

Easily separates from *hirtilineata* on the much darker wings and legs. It is a relatively stouter insect.

Sciara khasiensis, sp. nov.

♂ *Head* black, face grey dusted. Eyes bare. Antennæ, scape dark brown, with first joint broader than the second, truncate, second globose; flagellum with first seven joints shortly pedicillate, remainder sessile, all subequal except the first joint, which is slightly longer than any of the others. Base of first joint pale, remainder, and whole of next five joints black, the remaining joints to the apex greyish brown. The colour difference between the sixth and seventh joints is not extremely marked, but between the base and apex of the flagellum it is quite apparent. Palpi of three very short joints, black.

Thorax: dorsum very dark brown, nearly black, with dorso-central rows of pale, short hairs, and similar, longer rows along side margins. Notopleural suture and postalar calli chestnut brown, pleura concolorous, except sterno-and meta-pleura, dark brown. Scutellum chestnut brown, its base darker, with apical hairs. Metanotum dark brown with paler sides.

Abdomen blackish, with the usual black, two-jointed lamellæ.

Legs: coxæ, trochanters and femora bright brownish yellow, tibiæ paler in ground colour, but with closer set black setulæ, apical spurs reddish- brown, tarsi blackish.

Wings almost clear, veins yellowish brown. Auxiliary vein short, only reaching half way to origin of third vein, which arises at half the length of the first. First vein just passing the fork of the fourth, of which the petiole is slightly longer than the branches, second posterior cell five times as long as broad. Upper branch of fourth vein slightly up-turned at tip. Fifth vein forking near base, its branches sharply diverging at half length. Sixth vein ending half way to wing margin. Halteres with yellow stem and dark capitella.

Long 3·75 mm.

Described from a unique female in good condition taken on grass along river bank, Laitlyngkot, Khasia Hills, on 16th October 1920. In my own collection.

This species separates from *Sc. flavofemorata* in Brunetti's table of Indian species, in couplet 11 by the longer second posterior cell and the paler wings and tibiæ.

CEROPLATUS NOTATICOXA, sp. nov. (Plate XIV, figs. 6, 12.)

♂ ♀. *Head* pale to dark yellow, blackened on vertex, and with a median dark line, broadened below, on face. Palpi very short, closely appressed to face, probably two-jointed, the basal very short, pale, the apical elongate reniform, black. (In the figure of the head the palp is shown pulled away from the face and not in its natural position.) Antennæ brown, the scape in some specimens darker than the flagellum. Eyes pubescent.

Thorax: dorsum ferrugineous brown, with very short erect black pubescence, and with traces of a pair of black lines converging V-like posteriorly. The posterior corners and scutellum darker brown, the latter with similar erect pubescence on the disc and without long bristles marginally. The bristles along the dorso-pleural margin very short, but numerous in front of the wing roots. Shoulders and pleura pale yellowish white, the former very noticeable from above. Posterior margin of hypopleuron blackened. Metanotum yellowish, its median area darker.

Abdomen pale yellow-whitish, thickly covered with black hairs, each segment with an apical black band, which in the male occupies most of the first segment and on the others not more than the apical quarter or fifth. In the ♀ the whole dorsum is more or less blackened, the pale colour only showing faintly towards the bases of the segments, male genitalia with basal joint of claspers large, fleshy, pale, the apical black, densely short haired. Female lamellæ yellow, downward-directed, apparently arising from a common plate which is much narrower than the preceding tergite, and standing well separated from the end of the abdomen.

Legs pale yellowish white, tibiæ slightly and tarsi considerably blackened owing to closely set setulæ. Posterior coxæ with a black spot at one-third their length and just before the tip; the extreme base of all femora blackened, the hind pair rather more broadly. In pale specimens the tip of the posterior tibiæ is also darker.

Wings much shorter than the abdomen in the male about as long in the female. The ground colour is slightly yellowish. A large black patch over

base third and fourth veins, a dark band from costa immediately beyond the upper branch of the third vein, fading away posteriorly, and above the third vein extending into the marginal cell to a varying extent. An apical infuscation, varying in depth and in distinctness of separation from the subapical band. None of the veins beyond the upper branch of the fourth quite reach the margin. Halteres with stem pale yellowish and capitella black.

Long 6–6·5 mm.

Described from eleven males, (including type), taken flying round a decaying stem of *Ficus religiosa* on 11th October 1921, a male taken on window, 22nd December 1919, and a female taken on window, 17th August 1919; all at Suduganga, Matale, Ceylon. Type, allotype and co-types in my own collection.

In describing below two new species of *Platyura*, Brunetti's key to the genus in the "Fauna of India" may be amended to include them. They will both run down to couplet 11, from which point the key will run as follows :—

11. Petiole of fourth vein at least one-third as long as the branches....12
    Petiole of fourth vein much shorter than this.....14
12. Antennæ brownish yellow, all veins distinct.....13
    Antennæ black, veins posteriorly indistinct....*indistincta*, Brun.
13. Thorax bright reddish brown, coxæ and femora yellowish. *ruficornis*, Brun.
    Thorax dull brown, coxæ and femora white.....*juxta*, sp. nov.
14. Head and antennæ mainly blackish, wings unmarked.....*longifurcata*, Brun.
    Head and antennæ mainly yellowish, wings with preapical spot.... *lunifrons*. sp. nov.

Couplet 13 of the key will then follow.

Platyura juxta, sp. nov.

♀. *Head* yellowish brown, epistome and palpi darker, ocellar area blackened. Antennæ pale greyish yellow, scapal joints no wider than first flagellar and very short. Occiput thickly black haired: a somewhat prominent small tuft of black hairs above epistomal margin. Eyes minutely pale pubescent.

Thorax yellowish brown, with narrow blackish dorso-central stripes, very indistinct, turned outwards and downwards anteriorly to the black shoulders. Dorsum thickly black haired, the lateral margins and an area between and behind the wing roots with much longer, bristly hairs. Scutellum and metanotum concolorous, the former with about eight strong marginal bristles

and many very short ones arising very slightly below the former. Pleura dull yellowish brown, bare.

Abdomen black, the hind margins of the segments very narrowly dirty yellow. The second segment with the anterior two-thirds of dorsum dirty yellow, and the apical sternite yellow; venter otherwise as dorsum. In specimens with distended abdomen the lateral suture will probably show as a dirty yellow line.

Legs white, tibiæ slightly and tarsi greatly blackened.

Wings smoky yellowish grey, all veins very distinct. There are traces of a dark suffusion below the tip of the third vein. Petiole of fourth vein over one-third the length of the branches. Halteres with stem whitish and capitella darker brownish.

Long 3·75 mm.

Described from a unique female in perfect condition, taken on window, at dusk, Suduganga, Matale, Ceylon, 8th October 1921. In my own collection.

Platyura lunifrons, sp. nov.

♀. *Head* yellow, occiput and face with black hairs: Ocelli within a round, black patch, yellow, prominent. On frons between ocelli and antennæ a raised luniform transverse area; its upper margin convex, with the extremities fitting into rather deep emarginations in the eyes, and the middle of its concave lower margin produced triangularly, with the apex between the roots of the antennæ; this triangular area with short black hairs. There is a depression across the lunule from below the mid ocellus to the base of the produced triangle. Antennæ yellowish grey, second scapal joint slightly darker than the first, which is yellowish white; first flagellar joint twice as long as second, its lower side emarginate basally, the base of the joint being half the width of the apex; apical joint twice as long as penultimate. Palpi yellowish, the two basal joints much broader than the two apical, but together not much longer than the third joint, which itself is little more than half as long as the still narrower fourth joint.

Thorax yellowish to reddish brown, with black hairs, which are numerous and strong along the dorso-pleural margin, increasing in length posteriorly to above the wing roots, where they become definite bristles, behind which, and on posterior margin, they are much sparcer. Scutellum concolorous, with its apical margin well bristled. Pleura yellowish, with some greyish shimmer, metanotum more greyish. The thoracic dorsum may have a pair of subdorsal brown stripes, but these are not always apparent, or well defined.

Abdomen yellowish brown with black hairs. An impressed transverse line to each segment subapically gives the appearance of concolorous apical bands to the segments.

Legs whitish, tibiæ and tarsi darkened, the latter greatly so.

Wings with distinct yellowish tinge, with a dark patch, more or less oblong in shape, just below tip of lower branch of third vein. Petiole of fourth vein about one-fifth as long as its branches. Halteres yellowish grey with darker capitella.

Long 4·5 to 5·5 mm.

Described from two females in good condition, taken, on windows, Suduganga, Matale, Ceylon, on 25th August 1919, and 9th August 1921 (type). Both in my own collection.

MYCOMYIA UNIFASCIPENNIS, sp. nov. (Plate XIV, fig. 1.)

♂. *Head:* vertex and frons pale brown with black hairs. Ocelli in a darkened area, the median one not distinguishable. A furrow runs from below the ocelli to above the antennæ, where the frontal colour is paler yellowish with no black hairs. Face yellowish, somewhat shining, epistome concolorous, not shining, with fine scattered dark pubescence. Antennæ, scape yellow, the joints apically with black bristles; flagellum, basal half yellow, the apical six or seven joints darkened to brownish grey. First flagellar joint twice as long as the second. Eyes very minutely pale pubescent. Palpi yellow, fourth joint as long as first three together.

Thorax: dorsum shining very dark brownish black. Shoulders pale yellowish white. A short yellow transverse line from in front of wing roots for a short distance upwards. The whole dorsum with black hairs and with strong bristles on anterior margin and corners, along the sides and across the hind margin before the root of the pale yellowish-white scutellum, which bears an apical pair of long, divergent bristles. Pleuræ pale yellowish white, except metapleura, which, viewed from side, are dark brown except lower corner, yellowish, viewed from behind, all yellowish. Metanotum dark brown,—sometimes with traces of a median pale line.

Abdomen dark yellow with black hairs. Second, third and fifth segments dorsally black, with narrow yellow anterior and posterior margins, the darkened area of the two latter descending further towards the wholly yellow venter than on the former, on which it is also narrowed below. Sixth segment varying from all black above—(and without any yellow band separating it from the fifth, on which the hinder band is then absent)—to dark yellow with only a lateral, basal, black spot. Genitalia dark yellow, the corners of the dorsal

platet urned downwards, and covered with golden pile, the tips with a row of hairs. External to these the tips of a subulate pair of claspers, also hairy, can be seen. Beneath the dorsal plate project the blunt tips of a pair of palp-like processes, closely approximated, and with their apices turned downwards. On mid line, ventrally, is a long, curved, thin process, its tip upturned nearly to meet the median processes, apically bilobed, with a tuft of short dark brownish stiff hairs.

Legs: coxæ pale whitish, the hind pair with a median row of bristles on the outer face. Femora yellow, the hind pair slightly darkened on the underside basally. Tibiæ and tarsi darkened, but without any yellow colour, the ground colour, below the closely set setulæ, whitish.

Wings: basal half hyaline yellowish. A median black band, darker above the fourth vein, its inner margin running from just before the tip of the auxiliary vein, across the base of the Sciophiline cell—(the inner upper corner of which is just clear)—slightly outward directed from lower end of the anterior cross vein, with irregular margin, to lower branch of fifth vein, which it meets before half its length, then slightly inwardly directed—(the colour is here much fainter)—to the wing margin just below the fork of the fifth vein. The outer margin of the band is nearly straight, running from just before the tip of the first vein to the tip of the upper branch of the fifth vein. Colour of wing external to the band hyaline grey. Veins yellow, except through the band, where they are black. The tip of the sixth vein, which enters the band, being thus well marked. Costa extending a little beyond the tip of the third vein but not reaching the apex. Sciophiline cell nearly square, its outer and lower sides equal. Halteres yellow.

Long 3·5 to 4 mm.

Described from two males both in good condition, except for the loss of one fore and one hind tarsus in the co-type, both taken on window, Suduganga, Matale, Ceylon, on 15th August 1921, at dusk, and on 17th August 1921, in early morning (type). Type and co-type in my own collection.

If *Neoempheria*, Osten-Sacken, is admitted distinct from *Mycomyia*, Rondani, this species will come in it.

Azana asiatica, sp. nov. (Plate XIV, fig. 4.)

♂. *Head* yellow, vertex, frons and face with dark hairs: palpi concolorous, the first three joints very slightly darker, the first two short, the third and fourth subequal and each as long as the first two together. Antennæ, scape yellow, both joints apically long setose above; flagellum pale brownish grey, thickly pale pubescent.

Thorax: dorsum orange yellow, with three slightly darker stripes, not well defined; scutellum concolorous, both with rough erect hairs of the same and slightly darker shades intermixed. Pleura and metanotum paler yellow. Pro- and hypo-pleura with rows of concolorous hairs.

Abdomen: seven-segmented, yellow, with rather thick concolorous pubescence, the third to sixth segments with a median transverse dorsal brown band, interrupted on the mid line. Genitalia large, complex, wider a little than the seventh segment, the side pieces long and large, touched with brown on their apical margins.

Legs: yellow, tarsi very slightly darkened. Extreme tips of coxæ, trochanters and femora touched with black.

Wings: hardly as long as the abdomen, with setulæ distinctly longer than usual, but not to the extent of *Leptomorphus*. Venation in accordance with the generic definition. Halteres yellow.

Long 3 mm.

Described from a unique male in perfect condition, taken on a window, Suduganga, Matale, Ceylon, on 16th September 1921. In my own collection.

Agrees entirely with Johannsen's definition of the genus in *Genera Insectorum*, except for the seven-jointed abdomen, which being so, somewhat exceeds the wing in length; the genitalia are more prominent than his description would indicate.

Manota orientalis, sp. nov. (Plate XIV. figs. 7, 8.)

♂. *Head:* frons black, short; face yellowish grey with golden hairs, stronger below. Antennæ directed upwards and forwards, brownish yellow 2+14 jointed. First scapal joint broad, short; second apically setose, broader, than the first flagellar. Flagellar joints compact, of approximately uniform length, the apical very slightly longer, all pale pubescent. Palpi pale yellow, very prominent; first joint coniform, the second attached to its outer side at about half its length, leaving a triangular flap projecting backwards behind the insertion of the second joint, which is three times as long as the first joint proximal of the point of attachment of the second; third narrow, not as long as second, directed angularly backwards—(generic character)—the whole organ pale pubescent. Eyes pale pubescent.

Thorax yellowish, with paler pubescence on anterior half of dorsum and black pubescence on posterior half, pleuræ concolorous, as is also scutellum, but with stronger dark pubescence and the apical margin definitely dark, with six marginal dark bristles of which the innermost pair are the longest and strongest. Metanotum pale yellow.

Abdomen yellow, the hinder segments darkened, with dark pubescence, segmental margins distinct but unmarked. Genitalia yellow, small, their structure not apparent.

Legs pale yellow, tibiæ and tarsi darkened owing to closely set setulæ. Mid and hind tibiæ with two apical spurs.

Wings greyish hyaline; third vein approximated to first. Costa ending before apex, but nearer upper branch of fourth than third vein. Fourth vein with only tip of upper branch and all lower branch of fourth present, petiole absent; fifth vein complete, sixth not apparent, seventh strong. Halteres dark yellow, capitella brown.

Long 2·5 mm.

Described from a unique male in perfect condition taken on window, Suduganga, Matale, Ceylon, on 1st September 1921. In my own collection.

The species runs more like a *Phlebotomus* than a Mycetophilid.

This species is at variance with Williston's definition of his genus in that the mid tibia has a double, not a single, spur. Although the third palpal joint is in accordance with the generic definition, the latter says nothing in regard to the remarkable prolongation of the first joint, which is therefore presumably absent in the West Indian species for which the genus was founded. The description of Meunier's fossil species is not accessible to me, but as Johannsen sinks the genus erected by Meunier for it in Williston's living genus, I take it that the palpi show no difference therefrom. In Johannsen's figure of the wing, which is after Williston (*Genera Insectorum*, Fasc. 93 Pl. IV, fig. 21), the petiole of the fifth vein is shown incomplete, which is not mentioned in the generic definition. These trifling differences do not justify the erection of a new genus.

KEY TO THE DESCRIBED SPECIES OF INDIAN EXECHIA.

1. Dorsum of thorax yellow to orange 8
   Dorsum of thorax dark borwn to black 8
2. Dorsal margins, viewed from above, paler than central area 3
   Dorsal margins, viewed from above, not paler than central area 7
3. Larger spp. (5 mm.). All yellow, pale margins ill-defined 4
   Smaller spp. (3 mm.). Pale margins well-defined and usually reaching posterior corners 5
4. Abdomen not compressed—antennæ erect .. .. *flava*, sp. nov.
   Abdomen compressed—antennæ porrect .. .. *basilinea*, Brun.
5. Dorsum bright orange, margins brilliant silvery .. .. *argenteofascia*, mihi.—*a.*
   Dorsum with darker stripes, margins whitish 6
6. Abdomen with dorsum all black .. .. .. *mirastoma*, sp. nov.
   Abdomen with dorsum of fourth and seventh segments white .. *albicincta*, sp. nov.
7. Dorsum with paler median V-mark bordered by erect bristles, posterior subdorsal area brownish .. .. .. ***cristata*, mihi.**

	Dorsum all yellowish brown, no definite markings	*zeylanica*, mihi.
8.	Pale lateral margins broader, extending across base of scutellum, central black patch narrowed anteriorly	*ampullata*, mihi.
	Pale lateral margins narrower, not extending across base of scutellum, central dark patch with median markings ..	9
	Pale lateral margins wanting	*paramirastoma*. sp. nov.
9.	♂ antennæ longer than head and thorax	*longicornis*, sp. nov.
	♂ antennæ shorter than head and thorax	*brevicornis*, sp. nov.

Exechia albicincta, sp. nov.

♀. *Head*: black, frons covered with pale silvery hairs. Epistome dark yellow, palpi pale yellow. Eyes with microscopic pale pubescence. Antennæ, scape and first three flagellar joints yellow, remainder brownish with white pubescence.

Thorax: dorsum dull yellowish brown, the sides, viewed from above, obscurely whitish. A pair of subdorsal dark stripes, fading away anteriorly, converging V-like at base of scutellum, their inner edges marked on the anterior third (where they are evanescent), by lines of diverging black bristles. Scutellum yellow, with admedian black stripes continuing the mesonotal bars leaving only the centre and extreme edges yellow. An apical pair of strong, divergent, black bristles. Shoulders and lateral margins of mesonotum with black bristles, a very strong one on each hind corner. Pleura: pteropleuron yellow, meso- sterno- and hypo-pleura black with grey shimmer. Metanotum black with vertical yellow bars descending from lateral corners of scutellum for some distance.

Abdomen: dorsum very dark brownish to black. Base and extreme hind margin of first segment pale; fourth, except for anterior margin broadly, and seventh segments yellowish white. Laterally the abdomen is pale yellowish white on all segments except the sixth, but on second, third and fifth the dorsal black descends to ventral margin on fore and hind edges, the upper margins of the white areas being evenly arched. Venter yellowish white, as are also the small genital lamellæ.

Legs: pale, tibiæ somewhat and tarsi greatly blackened. Tips of hind femora obscurely darkened. A black bristle just beyond base of hind coxæ on the outer side.

Wings: slightly greyish hyaline; third vein running very close to first, and absolutely straight; fifth forked far beyond fourth. Halteres white.

Long 2·75 mm.

Described from a unique female in perfect condition, taken on window, Suduganga, Matale, Ceylon, on 26th September 1921. In my own collection.

Exechia brevicornis, sp. nov.

♂. *Head* black, frons with pale pubescence. Lateral ocelli golden, prominent. Some bristles around eye margins, eyes minutely pale pubescent. Antennæ short, not as long as head and thorax; scape and first flagellar joint yellow, remainder greyish brown with pale pubescence.

Thorax dark brown with pale front and lateral margins, bristly at sides and above shoulders, and with a single, strong, postalar bristle. An indistinct V-shaped yellowish brown marking medianly, only visible when viewed from in front. Scutellum dark brown with a pair of long, divergent, apical bristles. Metanotum dark brown; pleuræ brown, propleuron and upper half of pteropleuron yellower.

Abdomen black, laterally compressed. All segments dorsally and laterally very narrowly edged yellow on posterior margins. Genitalia not swollen, yellow. Beyond the side pieces are an elongate pair of narrow rod-like processes, blackish, with two strong black spines at the tip of each, arising from middle of lateral margin; below them are two shorter, narrower processes, also with black hairs, and a pair of ventral processes nearly hidden in strong bristles.

Legs yellow, tibiæ and tarsi darkened, as are also the tips of posterior coxæ.

Wings greyish. Halteres pale yellow.

Long 3·5 mm.

Described from a unique male in good condition, taken in pinewoods, Shillong, on 9th October 1920.

Type in my own collection.

This species is superficially very similar to *E. longicornis*, but the elongate antennæ and very different genitalia will at once serve to separate the males.

The females of both, unfortunately, remain unknown.

Exechia longicornis, sp. nov.

♂. *Head:* frons black, with silvery pubescence, the prominent lateral ocelli yellow. Face yellowish. Eyes very minutely pale pubescent. Some bristles on frons along eye margins, and a median pair, divergent, above root of antennæ. Antennæ considerably elongated, longer than head and thorax, about as long as mid tibia. Scape yellow, both joints with apex above and below with black bristles. Flagellum with basal half of first and extreme base of next two joints yellow, remainder greyish brown, the apical joint half as long again as the penultimate. Palpi yellow.

Thorax dark brown with sparce pale pubescence and black bristles on anterior and lateral margins, above shoulders, and postalar. The brown area is outlined by a pale margin along lateral margins of dorsum, whitish grey above the shoulders and more yellowish behind the wing roots. A medisn pair of ill-defined pale lines, converging V-like to root of scutellum, which is concolorous, with an apical pair of strong, divergent, bristles. Pleuræ brownish grey, propleuron and upper half of ptero-pleuron yellower, the former with several bristles as usual. Metanotum dark with paler lateral margins.

Abdomen strongly laterally compressed, black, with pale pubescence. The hind margins of the first and second segments and the anterior margin of the third, yellow, very narrowly so dorsally. Second and third segments all yellow ventrally. Remaining segments with traces of pale lateral margins. Genitalia, swollen, hairy, dark yellowish, apparently consisting of large yellow side pieces between which can be seen from above a pair of white laminæ, their inner margins only slightly separated, their outer curved strongly, their tips incurved to meet one another, so that the whole appears as a single cordiform plate with a dark median depression not reaching the extreme tip. From the middle of the side pieces, and, more closely approximated, from near their lower margins, extend posteriorly the tips of elongate processes, all with black hairs apically.

Legs yellow, tibiæ and tarsi, also extreme tips of hind femora, darkened.

Wings yellowish grey, halteres pale yellow.

Long 3·25 mm.

Described from a unique male in good condition, taken in deep shade, Shillong, on 15th October 1920.

Type in my own collection.

Exechia flava, sp. nov.

♂. *Head* yellow. Frons with a row of black bristles around eye margins, and above base of antennæ. Face slightly greyish tinged. Eyes minutely pale pubescent, palpi and antennæ yellow, the scapal joints of the latter with black bristles, the flagellar joints very slightly darkened on apical half. Antennæ erect, not porrect as usual.

Thorax all yellow, the median dorsal area slightly browner, the sides above the shoulders, whitish viewed from above. Strong bristles on front and side margins, and in postalar region. Scutellum yellow, crossed subbasally by a dark bar, with a pair of long, crossed, apical bristles, in front of which is a similar, much smaller pair. Metanotum concolorous, with a pair of vertical brown bars admedianly, very narrowly separated. Pleuræ yellow.

Abdomen not laterally compressed, yellowish, with black hairs; the junctions of the second to sixth segments indefinitely darkened, with, on second and third, traces of a dark median line connecting the darkened areas at front and back margins of the segments. Hind margin of sixth segment not darkened, concolorous with genitalia. First segment with a well defined yellowish-white bar on hind margin. Genitalia brighter yellow. A pair of thin processes arising from above and below on each side meet beyond the side pieces, the lower pair, which are innermost, with a long, black, spine-like bristle at their tips. A median ventral plate, above which is a median upward directed thorn-like organ, can be seen from above between the four processes beyond the end of the side pieces.

Legs yellow, tibiæ slightly and tarsi greatly darkened. Hind femora basally darkened along upper and lower edges.

Wings very yellowish. Halteres pale yellow.

Long 5 mm.

Described from a unique male in good condition, from Cherrapunji, on 18th October 1920.

Type in my own collection.

This species is very close to *E. basilinea*, Brun., from which it differs by the barely darkened apical part of the flagellum, the uncompressed abdomen, with much less definite markings, and the darkening at the base of the hind femora. The genitalia appear different, as the long spine at the tip of the lower processes is not mentioned in Brunetti's description of his species, though it is very conspicuous. Similarly I have not been able to distinguish the lemon-yellow palp-like appendages in the place of the dorsal plate, to which Brunetti refers. Descriptions of unmounted genitalia, however, are very unsafe things to go by.

Exechia mirastoma, sp. nov. (Plate XV, fig. 11.)

♂. *Head* black, with pale pubescence on frons. Face very narrow, somewhat yellowish medianly. Eyes minutely pale pubescent. Palpi yellow, apical joint brown. Mouth parts prolonged, apparently consisting of a membranous plate, strengthened with two parellel bars of yellow chitin, and bounded exteriorly by a pair of yellow, elongate, acuminate organs (like *Tabanus* palpi), with their apices crossed. Antennæ much shorter than head and thorax, scape and first flagellar joint yellow, remainder greyish brown with pale pubescence.

Thorax dorsum yellow-brown with median paler V-shaped area and whitish lateral margins, only visible when viewed from above. A small dark

area just above wing roots, behind which is a yellow marginal area containing a long postalar bristle. Front and lateral margins bristly, and along each side of central V-mark nearly as far back as the level of the wing roots, but these do not form a dorsal crest, but are directed to lateral, overhanging the steep slope of the thorax on each side. Scutellum dark brown with an apical pair of divergent bristles. Metanotum brown, pleuræ brownish.

Abdomen laterally compressed, black. Hind margin of first segment laterally very narrowly pale, venter of second, third and fourth segments all yellow, but without pale lateral posterior bands above. Genitalia yellow small, beyond the side pieces the almost filiform processes more or less concealed in a tuft of black bristles.

Legs yellow, tibiæ and tarsi darkened.

Wings greyish. Halteres yellow, with black clubs.

Long 2·75 mm.

Described from a unique male in good condition, taken in the pinewoods, Shillong, on 9th October 1920.

Type in my own collection.

It is much to be hoped that further specimens of this species will come to hand, to enable the extraordinary structure of the mouthparts to be properly made out.

Exechia paramirastoma, sp. nov.

♂. *Head* frons yellowish grey, with black hairs; a row of short black bristles above the antennæ, below which the colour is more yellow; face yellow. Palpi short, first joint yellow, remainder brown. Proboscis yellow, apparently similar in structure to *E. mirastoma*, sp. nov. Antennæ with scape and base of first flagellar joint yellow, remainder brownish grey with minute white pubescence. Lower edge of first scapal joint noticeably black bristled. Eyes practically bare, the pubescence extremely minute, pale.

Thorax dorsum very dark brown, the anterior margin narrowly paler owing to a little silvery pile, and the supra-alar region yellowish. There are traces of a median paler V-mark anteriorly, along which are a few irregularly placed black bristles. All the dorsum with short black hairs. The anterior margin bristly, as are also the lateral margins, especially towards the wing roots, and with several strong alar bristles. An acrostichal prescutellar pair, golden brown in colour. Pleura pale whitish, pro-, meso- and meta-pleura brown, the last with a vertical row of three strong bristles. propleuron with two sets of bristles, the upper, smaller set variously directed, the lower, three or four in number, declinate. Scutellum black, with a pale margin

viewed from below, with an apical, very strong, erect pair of black bristles, between which there passes a much smaller, subapical, porrect pair. Metanotum yellow, with median black bar nearly as broad as the scutellum.

Abdomen strongly laterally compressed. The first six segments all black on dorsum, except for a narrow pale apical ring to first segment. Venter yellow; laterally the dorsal black extends to venter on hind margins, but basally the yellow of the venter reaches about half way up the sides, making triangular yellow patches, except on first segment which has only the midline of the venter yellow, all the side being black. Seventh segment, except for extreme base, and genitalia brown, the lower edge of the former extending beneath the latter, its concave posterior margin with strong bristles.

Legs: coxæ yellow, femora concolorous, with dark hairs, tibiæ darkened and tarsi blackened. Fore trochanters with an elongate cuneiform black fleck on upper side.

Wings grey, fork of fifth vein practically immediately below the origin of the third vein. Halteres with pale stem and capitella darkened.

Long 3·25 mm.

Described from a unique male, in perfect condition, taken on window, Suduganga, Matale, Ceylon, on 4th November 1921. In my own collection.

Mycetophila khasiensis, sp. nov.

♀. *Head* pale brown with fine black pubescence, rather longer on the frons and vertex than on the face, which is slightly convex. Eyes minutely pale pubescent. Antennæ yellowish brown, the scape slightly paler, the flagellum with minute whitish pubescence. Palpi yellow, fourth joint straight and very little longer than the third.

Thorax brownish yellow with short golden pubescence and black hairs. Anterior and lateral margins, especially in front of wing roots, humeri and postalar region, bristly, a prescutellar dorso-central pair. Scutellum concolorous, with four marginal, parallel, bristles. Metanotum and pleuræ rather paler brownish yellow.

Abdomen yellow-brown, strongly compressed, the dorsum darkened, with pale hind margins narrowly to the segments dorsally and laterally. Ovipositor flattened, ensiform, the lower margin evenly curved to the very slightly erected tip, the upper margin broadened on basal third to a shoulder, whence it is evenly curved to tip. In the notch of the shoulder the slightly darker yellow, black haired lamellæ are situate.

Legs yellow, tibiæ and tarsi somewhat darkened. The inside range of setæ of mid tibiæ much shorter than the two outer ranges, of five bristles, the

lowest much the longest, and all crowded towards the middle of the joint. Inner range of hind tibiæ also much shorter than the two outer ranges, but the differences in size between the individual bristles is not so marked—(though the lowest is again the longest)—and the range extends over the apical three-quarters of the joint.

Wings and halteres yellow.

Long 4·5 mm.

Described from a unique female in good condition, taken on a window, Shillong, on 11th October 1920.

Type in my own collection.

In Brunetti's key to the genus in " Fauna India, Nematocera " this species divides from his *cinctiventris* on the unicolorous thorax.

PSYCHODIDÆ.

Pericoma metatarsalis (Brun.) var. *khasiensis* (nov. var.) (Plate XV, figs. 2, 3, 4.)

♂ ♀ . *Head* black, covered with white scale-like hairs, a fan of which overhangs the mouth parts, which appear to be formed for biting. Antennæ pale brown with white hairs, 2+14 jointed, the scapal joints wider than the flagellar, the first short, the second globose ; flagellar joints, the first shorter than the next ten, the next two about as long as the first, the apical rather longer than any other. Palpi five jointed, the first three joints stout and long, the two apical thinner and shorter, subequal.

Thorax black, thickly clothed with erect white scales, those on the posterior half of the dorsum of a dirty white, with their tips darkened. A very strong tuft arises from the postalar calli. Scutellum similarly clothed.

Abdomen black, with erect white thread-like scales. Male genitalia dark brown, more or less concealed amid white hairs in unrubbed specimens, the lamellæ at the tip of the inferior claspers brownish yellow. Female ovipositor yellow-brown, laterally compressed, slightly down-curved, prominent.

Legs dark brownish (the female femora paler yellowish brown) with scattered white hair-like scales on femora and tibiæ, the latter with their tips ringed by flat white scales. All metatarsi with rather more than the apical half white, the remainder of the tarsi very black. Along the inner side of the metatarsi is a narrow black area running through the white, so that, viewed from certain positions, the metatarsi appear all black. Hind tibiæ with so many white hairs as to appear quite white on basal three-quarters, with some outstanding long white hairs above, a row of stiff dark hairs below towards the middle, and a tuft of such all round the tip.

Wings with divaricate rows of brown hairs along the veins, only slightly overlapping one another. From second to seventh a black spot at the tip of each vein formed of closely approximated hairs. There are erect hair-like scales in tufts as follows :—on petiole of upper branch of second vein (white), at fork of upper branch of second (thick, black), which continues, less densely (black) along each branch, and on the lower branch of the vein immediately below, as far as a point almost below the tip of the first vein, at which point the black gives place to small white spots; at fork of fourth vein (black), on middle of upper branch of fourth (white), at one-third and two-thirds length of fifth (white), and at two-thirds of seventh (white). Base of wing covered with upstanding grey scales among which are some white ones. Wing fringe black, very dense on costa, and long on hind margin; the outer half shows white between tips of lower branch of second and third veins at extreme apex. Halteres black.

Long 1·5 mm.

Described from four males and two females taken on leaves of scrub-forming hedges, Mawphlang, Khasia Hills, on 10th October 1920. Type, allo-type and other specimens (one dissected and mounted), in my own collection.

Except the types, none of the specimens are in good condition. The day was wet, cold and dull, and they have suffered in a damp net.

I hesitate to make a new species of these specimens, as they accord well with Brunetti's description, save that he states that the fringe of the wing at the tip is composed wholly of white hairs, whereas in my specimens the fringe is black at the base throughout, and only the outer half of the hairs are white.

Further, the white section is much shorter than Brunetti describes. The description of *metatarsalis* is a differential one,—so I have described my variety at length,—as it may prove a good species, when males of *metatarsalis* come to hand, and it becomes possible to examine the male genitalia.

Simuliidæ.

On the Indian species of the genus Simulium, Latreille.

Since 1911, when Brunetti described seven species, all from the Himalaya and Assam Hills, with two of the species extending to the Western Ghats in North Kanara, nothing further has been done in the study of the Indian forms. The same author, in the following year, added a very distinct species from Ceylon, the distribution of which was later extended to the Palni Hills of the extreme South of the Peninsula by Patton and Cragg, who included it in their table of Indian species, Brunetti having described it too late for inclusion

in his table in the 'Fauna of India.' Although Patton and Cragg appear to have bred the species they say nothing about the male which, if I am right, is very different to the female. Five out of seven of Brunetti's species are described from examples of one sex only, and regarding two of them, he considers that they possibly represent alternative sexes of a single species. As other species, when their alternative sex is discovered, may also show sexual differences, in the table now offered I have indicated the sex of the species indicated. The male of *striatum*, described herewith, I take to be that species, as I have found it in company with undoubted females though not actually *in cop.*, which alone can settle the matter. *S. striatum* is the only species hitherto recorded from Ceylon, although I take this opportunity of recording the capture of a male *grisescens*, hitherto only known from a unique male from Kurseong, on a window at Suduganga, Matale District, on 13th January 1920, which affords yet another instance of that close relationship which exists between the dipterous fauna of the Island and the Eastern Himalaya.

Except for Patton and Cragg's record, the *Simuliidæ* of the Madras Presidency have remained quite unknown, but three species are now described. I have not seen examples of *striatum* from the Palnis, and such may form an annectent link between *striatum* of Ceylon and *latistriatum* from the Nilgiris, which, although their descriptions read much alike, appear perfectly distinct when the two species are placed side by side.

KEY TO THE INDIAN SPECIES OF *SIMULIUM*.

(Based on Brunetti's key in 'Fauna of India.')

1. Thorax unstriped .. .. 2.
   Thorax striped .. .. 12.
2. Thorax black, at most with dull reddish brown tinge .. 3.
   Thorax distinctly reddish brown, with short yellow hair .. *rufithorax*, Brun. ♂ ♀
3. Thorax with grey shoulder spots and a wide greyish band on posterior margin .. .. *grisescens*, Brun. ♂
   Thorax without definite shoulder spots ,and with no posterior band .. .. 4.
4. Abdomen destitute of any signs of yellow hair .. .. 5.
   Abdomen with short bright yellow hair, or with rather long brownish yellow shaggy hair .. .. .. 10.
5. Hind metatarsus much incrassated, nearly as long and as large as its tibia .. .. *metatarsale*, Brun. ♂
   Hind metatarsus not so conspicuously incrassated, distinctly less in size than its tibia .. .. 6.
6. Antennæ wholly black. Length 2·5 mm. .. .. *griseifrons*, Brun. ♀
   Antennæ reddish yellow at base. Smaller species .. 7.

7.	Femora black	8.
	Femora yellow or pale brown	9.
8.	Fore tibiæ whitish yellow	*rufibasis*, Brun. ♀
	Fore tibiæ black	*pattoni*, sp. nov. ♀
9.	Mid femora dark	*striatum*, Brun. ♂
	Mid femora yellow	*gurneyæ*. sp. nov. ♀
10.	Abdomen with normal, short, very bright yellow hair ..	11.
	Abdomen with distinctly longer, shaggy, brownish yellow hair .	*senile*, Brun. ♂
11.	Abdomen with at least the first two segments distinctly yellowish or brownish yellow; often several segments so coloured	*indicum*, Becher. ♂ ♀
	Abdomen all black	*aureohirtum*, Brun. ♂ ♀
12.	Admedian grey stripes much wider than the acrostichal black stripes	*striatum*, Brun. ♀
	Admedian grey stripes hardly as wide as the acrosctichal black stripes	*latistriatum*, sp. nov. ♀

Simulium striatum, Brunetti.

♂ . *Head* black, face with pale brassy pubescence. Antennæ stout, reddish-brown, with pale pubescence, appearing almost yellow in some lights, in others darker, but never black, and always unicolorous from base to tip. Proboscis and palpi brown, a little darker than the antennæ, the basal joint of the palpi not incrassate.

Thorax black, the dorsum covered with bright brassy golden hairs, usually more or less denuded on middle third, with no traces of the female stripes. Pleuræ dark grey, with ashy grey reflections, and sometimes a tinge of brown on humeri and sternopleura. Scutellum black, with brassy golden hairs and some apical black bristly ones. Metanotum black, with minute brassy pile.

Abdomen black, with some microscopic pale hairs on dorsum, but no golden ones, the basal hair fans brown. Genitalia concealed.

Legs : fore coxæ yellow, with pale hairs, trochanters darker, also with pale hairs, femora and tibiæ pale brown, tarsi blackish. Posterior coxæ dark (except apex of mid pair, pale), trochanters pale. Mid femora dark except extreme tip tibiæ dark brown with pale base, tarsi blackish. Hind femora brown, tibia incrassate, as large as femur, with base pale, otherwise concolorous. Metatarsi with basal half pale and apical dark, second joint pale at base, remainder black, third and fifth joints black, fourth pale with a black line across the middle. Hind metatarsus as long as tibia—but half its width.

Wings normal, with veins yellow. Halteres golden brown.

Long 1·5 to 2 mm.

Described from 8 males all in good condition, taken on windows, Suduganga, Matale, Ceylon, as follows :—three on 28th December 1919, in company with 3 females ; on 18th, 22nd, and 23rd January 1920 ; and 20th March 1920. All in my own collection.

Simulium latistriatum, sp. nov.

♀ *Head* dark grey, face more ashy grey. Frons triangular. Antennæ with scape yellowish, flagellum very dark brown, with pale pubescence. Palp black, basal joint hardly thickened. Proboscis brown.

Thorax ash grey, with pale silvery hairs. Five black stripes, broader than in *S. striatum*, median, acrostichal, and subdorsal, the outer pair on each side joined along the fore margin, and thus the grey ground colour only reaching the fore margin each side of the median stripe, which hardly reaches the margin. All stripes stopping just before the level of the wing roots, and the acrostichal pair slightly convergent anteriorly. The posterior quarter of the dorsum is all black viewed from a low angle in front, and all grey from an equal angle behind. Pleuræ dark brownish grey, scutellum concolorous, hind margin on underside a little brownish. Metanotum dull black. Scutellum denuded, probably in life with the pale pubescence of the thoracic dorsum.

Abdomen black, the latera lbasal hair fans pale.

Legs : fore coxæ yellow, posterior pairs blackish ; all trochanters and femora yellow ; all tibiæ yellow with black tips. Fore tarsi all black, the first three joints enlarged. Mid metatarsus and second joint whitish with black tips, third and fourth joints more or less brown, fifth black. Hind metatarsus two-thirds as long as tibia, and half its width, whitish with black tip, second joint similar, in colour third to fifth brownish.

Wings normal, veins very pale yellow-white. Halteres bright yellow.

Long 1·25 mm.

Described from two females in good condition, biting bull, Coonoor, 25th September 1920, at dusk. Type and co-type in my own collection.

Simulium pattoni, sp. nov.

♀. *Head* black, frons and face ash grey with silvery hairs. Occipital margins laterally with pale hairs. Antennæ, scape and first flagellar joint yellow, remainder dark brown. Palpi black, basal joint thickened, but not as long as the second. Proboscis reddish brown.

Thorax: dorsum and scutellum black, covered with bright golden hairs, the latter with black marginal hairs also. Pleura dark grey with ashy reflections; propleuron with a tuft of white hairs.

Abdomen black, with scattered very short pale hairs; lateral basal hair fans pale.

Legs fore coxæ yellow-brown, posterior pairs black. All trochanters and femora black. Fore tibiæ and tarsi black, the former with some short golden hairs on the sides, the latter with the first three joints enlarged, Posterior tibiæ black with whitish bases. Mid tarsi very dark brownish, basal half of metatarsus pale, fourth joint obcordate, the two lobes pale. Hind tarsus with basal half or two-thirds of meta,—extreme base of second and lobes of the obcordate fourth joint, pale, remainder black.

Wings normal, veins pale yellow. Halteres bright yellow.

Long 1·5 to 2 mm.

Described from five specimens, all taken on bull at dusk, Coonoor, on 25th September 1920. Type and others, some in indifferent condition, in my own collection. I have much pleasure in dedicating this species to Major W. S. Patton, I.M.S., at that time Director of the Pasteur Institute of Southern India, in grateful acknowledgment of many pleasant hours spent in his laboratories.

Simulium gurneyæ, sp. nov.

♀. *Head* dark grey, face shining whitish grey. Antennæ with scape and two basal flagellar joints yellowish brown, remainder blackish brown. Palpi black basal joint long, thickened. Proboscis black with brown labella.

Thorax dorsum black with indefinite ashy reflections above the fore corners, and rather sparce brassy hairs, scutellum concolorous, with long black hairs on hind margin. Pleura ash grey.

Abdomen black, dorsum with scattered pale pubescence, lateral basal hair fans pale golden. Base of venter yellow or brownish.

Legs: fore coxæ yellow, posterior pairs dark. All trochanters and femora yellow, tibiæ yellow with black tips. Fore femora almost white in certain lights. Fore tarsi all black, the first three joints greatly enlarged. Mid metatarsus yellow with apex darkened, second joint with extreme base pale, remainder and third and fourth joints dark brown, fifth black. Fourth joint obcordate. Hind metatarsus as long as tibia, and a little more than half its width, pale, with black tip, second joint with basal half pale, remainder, and third or fifth joints, black.

Wings normal, veins pale yellow. Halteres bright yellow.

Long 2 to 2·5 mm.

Described from fourteen specimens, some in good, some in indifferent condition, taken on bull at dusk, Coonoor, 25th September 1920. Type, and other specimens in my own collection.

I have much pleasure in dedicating this species to Mrs. W. S. Patton, well known, in collaboration with her husband, in the study of Indian blood-sucking Diptera.

TIPULIDÆ

Dicranomyia nitidithorax, sp. nov.

♀ *Head:* occiput and vertex brownish black, frons black with silvery pubescence, a full third of the width of the head, not narrowed below, very long, so that the antennæ practically touch the base of the blackish proboscis, with which the palpi are concolorous. Antennæ, first scapal joint yellow, second globose, wider than the first, black; flagellum black, joints well defined, the acuminate apical twice as long as the penultimate, elongate flask-shaped, the whole antenna clearly fourteen jointed.

Thorax: dorsum deep shining very dark brownish black, unmarked, rather highly arched, with presutural dorso-central rows of hairs. Humeri pale yellowish. Scutellum and metanotum concolorous with mesonotum and equally shining. Pleura concolorous, with shimmery white pubescence only visible in certain lights.

Abdomen somewhat shining. Under a low power it appears brown, the apices of the segments yellow banded; under a high power the first six segments show yellow, semi-transparent, the dark organs showing through, the brown coloration not being visible; seventh segment dark brown, eighth black with median transverse grey band. Ovipositor dark brown with short yellow valves. Venter, first seven segments brownish yellow, the segmental junctions very narrowly darkened, eighth segment blackish.

Legs: coxæ and trochanters and bases of femora yellow, the latter gradually darkening to brown, tibiæ brown, tarsi blackened. (Hind legs missing beyond trochanters.)

Wings uniformly grey, iridescent, stigma distinct but its margins ill defined. Tip of auxiliary vein exactly in line with base of prefurca, the fork of which is just before the tip of the first vein, being thus much shorter than the second vein itself. Basal section of third vein four times as long as the anterior cross vein, which is situate at the upper basal angle of the discal cell, which itself is nearly as long as the second or third posterior cells. Submarginal cell considerably longer than the first posterior. Posterior cross-vein

slightly proximad of the base of the discal cell. Halteres yellow with capitella black.

Long 35 mm.

Described from a unique female in fair condition (legs damaged), taken at Shillong, on 14th October 1920. In my own collection.

The very wide frons and general facies show that this species is allied to Brunetti's *nigrithorax*, but against its being the female of that species are the yellow first scapal joint, shorter prefurca, normal number of antennal joints, absence of gold dusting on thorax, and yellow coxæ.

Libnotes. (*Westwood.*)

In his key to the Indian species of this genus in the '*Fauna*' Brunetti omitted two Indian species, as he notes in his '*Catalogue of Oriental Nemocera.*' In adding two new species from Ceylon, I herewith offer an amended table of the Indian forms.

1.	Wings unmarked,—(except for stigma, present or absent) ..	2.
	Wings more or less conspicuously patterned	3.
2.	Body bright orange red	*thwaitesiana*, Westw.
	Body yellow-brown, abdomen banded	*immaculipennis*, sp. nov.
3.	A cross-vein in submarginal cell	*fuscinervis*, Brun.
	No cross-vein in submarginal cell	4.
4.	Marginal cross-vein nearly twice its own length before tip of first vein	*poeciloptera*, O. S.
	Marginal cross-vein at most its own length distant from tip of first vein	5.
5.	Surface of wing with large spots crossing from vein to vein ..	*notatinervis*, Brun.
	Surface of wing with practically only the veins patterned ..	6.
6.	Scape, proboscis and palpi yellow	*distincta*, sp. nov.
	Scape, proboscis and palpi blackish	7.
7.	Second and third veins absolutely unmarked beyond base ..	*notata*, v. d. Wulp.
	Second and third veins narrowly spotted along their courses ..	*punctipennis*, Meij.

Libnotes immaculipennis, sp. nov.

♂ ♀. *Head* grey, occiput with longish black hairs; frons very narrow, whitish. Antennæ, scape pale brown, with apices of both joints (the first broadly), yellow; flagellum darker brown, basal joints nearly twice as long as broad, the apical narrow, elongate the last not much longer than the penultimate. Hairs of flagellum not much longer than the individual joints. Proboscis and palpi brown.

Thorax yellow: a brownish stripe occupying the whole dorsal surface of the neck and running to suture—(in female more reddish brown posteriorly)—

postsutural calli with large brown spots, median area and scutellum pale yellowish. Dorso-central rows of black hairs on both portions of mesonotum. Metanotum brownish yellow. Pleura yellow, unmarked.

Abdomen brown, apices of segments yellow banded, more distinctly so in female. Venter yellowish. Male genitalia yellow, claspers blunt, black tipped. Ovipositor reddish yellow.

Legs : coxæ, trochanters and tips of femora yellow, remainder of femora tibiæ first two tarsal joints wholly, and basal half of third, brownish yellow tip of third and last two tarsal joints blackish.

Wings, except for a fairly well defined brownish stigma, clear, absolutely without markings on veins or membrane : not as elongate as in the remainder of the Indian species. First vein ending free, joined to costa by an indistinct branch at right angles, *proximad* its own length of the subcostal cross-vein, the true vein, which is marked by the line of short hairs on it, continuing to margin of stigma. Posterior cross-vein beyond middle of discal cell. Halteres yellow, capitella blackened.

Long 5 mm.

Described from a pair, the female taken on 15th December 1918, the male on 19th November 1919, both at Suduganga, Matale, Ceylon. In my own collection.

Libnotes distincta, sp. nov. (Plate XIV, fig. 3.)

♂. *Head* yellow, frons almost pinched out above, triangular below ; face greyish-yellow. Proboscis whitish yellow, palpi deeper yellow. Antennæ, scape yellow, flagellum very pale grey-brown, the basal joints nearly as broad as long, the apical joint twice as long as the penultimate, the hairs on the joints slightly longer than the joints themselves. Vertex elevated above eye margins, occiput with long yellow hairs.

Thorax yellow, mesonotum with front and side margins slightly brownish. From fore margin a concolorous stripe, which at one-third of the distance to the suture separates into two admedian stripes, which do not quite reach the suture. At half the distance from fore margin to suture commence a pair of subdorsal concolorous stripes, slightly darkened posteriorly, which cross the suture and become indefinite spots on postsutural calli, the middle depression pale whitish-yellow, scutellum concolorous. Pleura pale whitish yellow, notopleural suture darkened below the dorso-marginal brown band, a dark brown stripe starting on neck, passing above base of front coxæ to middle of pteropleuron, on front half of which it is ill defined. An interru ted brown stripe across middle of front coxa, sternopleuron, bases of posterior coxæ to a

spot on hypopleuron. A brown spot at middle of front side of mid coxa. Metanotum yellow, brownish at sides, with a small black spot below the corners of the scutellum.

Abdomen yellow with dark brown lateral stripes. Genitalia yellow.

Legs yellow, femora with a brown subapical ring, tips of tibiæ and first three tarsal joints slightly infuscated, last two tarsal joints blackened. Ungues with a strong tooth some distance beyond base.

Wings with numerous short black lengths on the otherwise pale yellow veins, around which are often almost imperceptibly faint infuscations. Marginal cross-vein nearly its own length before tip of first vein. Halteres stem yellow, capitella brown.

Long 6 mm.

Described from a unique male in good condition, taken at light, Suduganga, Matale, Ceylon, on 27th November 1919. In my own collection.

RHIPIDIA ZEYLANICA, sp. nov. (Plate XIII, figs. 2, 5.)

♂. *Head:* frons varying in width from that of the two conjoined narrow parafrontalia to one-third that of head, grey. Face concolorous, proboscis and palpi dark grey-brown. Second joint of palpi swollen, more than twice as wide as first joint. First and second joints subequal in length, third and fourth half as long again, subequal, and narrower than first joint. All joints hairy. Antennæ pale brown, first scapal joint twice as long as wide, wider at three-quarters its length than at tip, second vasiform; flagellum, first joint oblate spheroidal, second to ninth cylindrical (except fourth, rather more flask-shaped), tenth and eleventh irregularly rounded, twelfth round with elongate mammiliform apex. The third to eighth joints bear each a pair of finger-like darker brown processes, the second and ninth a single process, less well-formed than on the intervening joints, whilst the tenth and eleventh appear to have rudimentary processes. The processes are pale pubescent, and are longer and rather wider than the joints themselves on third to eighth joints. Occiput grey, with impressed median line and pale hairs.

Thorax brown, with minute pale golden pubescence, the absence of which from certain areas forms darker stripes thus:—a broad median stripe from suture, divided at rather more than half the distance to the anterior margin into three parallel lines, and submedian narrower stripes commencing at the forking point of the median stripe (where they are incurved towards it), and continued across the suture to postalar calli. The forking of the median stripe may not occur, it may continue broad to anterior margin, or the outer lines may disappear at half their length and appear again as spots on the

anterior margin. Pleuræ brown with pale golden pubescence, and a dark, almost black, band along sternopleural suture. Scutellum and metanotum concolorous with dorsum of thorax, the former with median darker stripe, and sometimes traces of the submedian thoracic stripes exterior to this.

Abdomen brown, with pale hairs, darkened to black at the junctions of the segments, and with a black lateral line. Genitalia bright yellowish-brown, apparently consisting of two large, subequal, fleshy joints, from inner basal sides of second of which arise a pair of re-curved brown hooks, bearing each on their upper sides at half their length an upward and backward directed spine, apically bifid. Below the large claspers is an unpaired stout median thorn-like process, its tip slightly down-curved.

Legs dull yellow, the femora subapically, the tibiæ and tarsi apically and very narrowly, very slightly darkened,—not always apparent,—(absent in type).

Wings grey, with very numerous slightly darker spots, noticeably on midcosta, over tip of auxiliary and first veins, at base of prefurca and third veins, and over the cross-veins. Veins yellow, the costal black at tip of auxiliary, first and second, the first above base of fourth, through the midcostal spot and at base of prefurca, the fifth, sixth and seventh with several small black lengths. Seventh veins somewhat sinuate. Halteres yellow.

Length: body 4 to 6 mm., wing 6 mm.

Described from four males, two in fair and two in bad condition, three taken at Emelina Estate, Maskeliya District, Ceylon (4,200 feet), on 12th, 13th January 1919, and one at Maskeliya Town, on 26th January 1919 (*G. D. Austin*). Type and other specimens in my own collection.

This species differs from Brunetti's *R. antennatus* (from Simla), by the dichoptic head and the different structure of the antennæ, the development of the flagellar processes extending to all joints in his species.

In the figure of the antennæ on Plate XIII the first flagellar joint is shown somewhat too small. It should be nearly as broad as the second scapal, and nearly half its length.

ERIOPTERA INCOMPLETA, sp. nov. (Plate XIV, fig. 11.)

♂. *Head* yellow grey, frons broad, one-third width of head, occiput with black hairs. Face concolorous, proboscis and palpi brownish. Antennæ; scape brown, the first joint somewhat grey dusted, about three times as long as broad, the second cupuliform, much broader than the first; flagellum, first joint yellow with the extreme tip brown, remainder brown, the first four or five joints rounded, closely sessile, gradually lessening in diameter, so that this part of the flagellum appears under a low power elongate conical, remaining

joints elongate, thin,—all joints from fourth onwards with verticals of a few hairs, the longest of which exceed the length of the first scapal joint.

Thorax grey, presutural dorsum with the usual four stripes, the outer pair not commencing until half length, in front of which there is on each side a small pit-like depression, appearing very dark. Humeri narrowly brownish. Post-sutural dorsum with the usual two dark spots, confluent medianly, the sides above wing roots pale grey, as are also scutellum and metanotum. Pleura brownish with grey dusting.

Abdomen reddish brown, basal and apical joints darker. Bases of third and subsequent segments narrowly yellow banded. Venter similar. Genitalia brown, paler than the last abdominal segment.

Legs : coxæ brown with grey dusting, remainder yellowish brown.

Wings smoky yellow brown, with a large dark fuscous spot around marginal cross-vein with a narrow costal band, nearly as dark, in the first submarginal cell. Subcostal cross-vein apparently at tip of auxiliary, marginal cross-vein near tip of first vein, ending below at bifurcation of second vein, or just on extreme base of its upper branch, which gradually fades out, not clearly reaching the costa. Posterior cross-vein just beyond the fork of the fourth vein. Fifth, sixth and seventh veins not approximated. Costa with longish hairs, those on veins not at all conspicuous. Halteres yellow ; capitella brown.

Long 4 mm. Wing 6 mm.

Described from a unique male in good condition, taken on *Lantana* scrub along river bank, Suduganga, Matale, Ceylon, on 5th July 1920. In my own collection. In Brunetti's table of Indian species this runs to couplet 2 and separates there on position of posterior cross-vein.

Acyphona indica, sp. nov. (Plate XV, fig. 7.)

♂ *Head* yellowish grey, frons narrow, with a median dark stripe. Face whitish grey. Antennæ yellow, apical half darkened, the whole flagellum with thick white pubescence. Palpi black. The antennæ if bent back would reach the wing roots.

Thorax reddish brown ; pronotum, anterior margin of mesonotum (except a narrow median stripe), and a short line extending forwards at the side of the dorsum from the suture, yellowish grey. A pair of admedian nearly black stripes, not reaching anterior margin and stopping at the suture, with the dorso-central rows of paler hairs exterior to them, these rows not separating postsuturally, where they are sparcer. Median area of postnotum slightly paler than the dark sides. Postalar calli yellowish. Scutellum very dark brown, metanotum concolorous in middle, sides yellowish. Pleura brownish,

propleuron more yellowish, mostly grey dusted. Pteropleuron with a fan of longish, soft golden hairs below wing roots.

Abdomen blackish, covered with pale yellowish long hairs. Genitalia brown not prominent.

Legs : coxæ and posterior trochanters greyish brown, remainder yellow, with concolorous hairs. Femora with broad subapical dark rings, tips of tarsi darkened.

Wings clear, veins yellow with numerous short black lengths, especially through the pale fuscous spots that are scattered over the wing along their courses. A darker band over the cross-veins. Hairs on veins not very dense, black. Venation typical, fourth posterior cell in one wing with an adventitious, incomplete, additional cross vein. Halteres yellow.

Length : body 5 mm. : wing 6·5 mm .

Described from a unique male in fair condition, taken in bungalow, Shillong, on 6th October 1920. In my own collection.

This is the first species of the genus to be described from the Indian subregion, the other two Oriental species being Malayan, from Java and Sumatra respectively.

GONOMYIA CONJUGENS, sp. nov. (Plate XV, fig. 8.)

♂ ♀. *Head* yellow, frons with a median dark area ; face, proboscis and palpi very dark brownish black. Antennæ, scape and first flagellar joint yellow, basal half of flagellum otherwise, brown, apical half yellowish. In male fourth to sixth flagellar joints with long, apical hairs, two or three to a joint each as long as about half the whole flagellum.

Thorax dark brown, notopleural suture and humeri whitish yellow, postsutural mesonotal depression slightly paler brown than remainder of dorsum. Scutellum yellow with median basal dark brown spot, much larger in male than in female. Metanotum dark brown with pale grey dusting. Pleura dark brown with a broad whitish band from base of fore to base of hind coxæ.

Abdomen black, with all segments except basal—(and that also, faintly, in male)—with yellow bands to hind margins, broader in the male, in which the bands are present, indistinctly, on the venter, which is not the case in the female, which has the venter reddish brown. Male genitalia brown, with three black linear chitinous processes, one directed posteriorly, two laterally. Ovipositor brown.

Legs yellow, all femora with broad dark subapical rings. Tarsi blackened.

Wings clear, with dark spots at tip of auxiliary, below tip of first, and at tips of both branches of second vein. Discal cell closed. Halteres yellow with black capitella.

Long 4 mm.

Described from a male in fair condition, taken in pine woods, Shillong, on 9th October 1920; and a female, in good condition, taken among guinea grass, Suduganga, Matale, Ceylon, on 21st November 1919. Both in my own collection.

The spotted wings and banded abdomen easily distinguish this species from the only other Indian species with closed discal cell.

The species affords another link between the faunas of Ceylon and the Khasia Hills.

Amalopis novempunctata, sp. nov. (Plate XV, fig. 5.)

♂. *Head yellow*, vertex with some longish concolorous and a few shorter darker hairs, frontal protuberance not prominent. Antennæ yellow, apical half of flagellum brownish, the joints after the first ill-defined. Scape hairy, flagellum with short whitish pubescence. Palpi dark brown. Proboscis yellow with tips of labella brown. Eyes apparently bare.

Thorax yellow, a dark ring at junction of head and neck. Prothorax very distinct, nodose, with longish black hairs on the sides of the protuberance. Mesonotum with slight, darker pile, and dorso-central rows of hairs as far as the suture. Around the suture are eight black spots arranged in a rough circle, the anterior pair dorso-central, smaller, the next pair presutural, towards lateral margins, larger, the next of same size, post-sutural and supra-alar, the hind pair large, dorso-central, but considerably before hind margin. In the centre of the circle, on mid line, its anterior edge resting on the suture, is a large black pentagonal spot. A short black streak on each side below the posterior corners. Pleura, scutellum and metanotum yellow, immaculate.

Abdomen yellow, with brown hairs. Second to sixth segments with a median ill-defined dorsal stripe, the lateral margins of second to fourth segments narrowly black, venter yellow, darkening to brown on fourth and subsequent segments, the third to fifth with short sub-basal black streaks submedianly. Genitalia dark yellowish, large, complex, with dark hairs.

Legs yellow. Tips of all femora, tibiæ and first three tarsal joints black, the latter very narrowly. Last two tarsal joints all blackish. Tibial spurs distinct, ungues yellowish.

Wings yellowish, costal, anal and axillary cells nearly clear. A very deep yellow stripe along both sides of first vein, edged blackish below, not reaching

to the fourth vein its lower edge parallel with first vein, with a black spot each side of sub-costal cross-vein, and a black streak over base of profurca. Costal cell with numerous short black transverse flecks, the pattern differing in the two wings ; some black suffusion around tip of auxiliary vein and along costal margin of submarginal cell. Below the tip of auxiliary the yellow colour around the first vein gradually turns brownish, and proceeds as a broad band to apex, its inner edge reaching margin in second posterior cell. This band contains a clear spot in outer half of marginal cell. A brownish suffusion over the cross-veins, with a branch from the base of the second sub-marginal cell to base of second posterior. Fifth vein with a brown streak lying just below it, and a pale brown spot over tip of seventh vein, reaching sixth vein above. Sub-costal cross-vein at one-third length of wing, marginal cross-vein just before tip of first vein, sub-marginal cells equal, discal cell open. Halteres pale yellow.

Long 11 mm.

Described from a unique male in good condition, taken on scrub in shade, Shillong, 9th October 1920. In my own collection.

The only point at variance with the generic definition is the non-pubescent eyes. The pattern of wing and thorax amply distinguishes this beautiful species from all its known Oriental congeners.

Limnophila fletcheri, sp. nov.

♂ ♀ . *Head* grey, vertex somewhat swollen, occiput with a postocular row of longish dark hairs well separated from eye margins behind and with the two rows not meeting on the vertex. Antennæ short in both sexes, pale brownish. Palpi black.

Thorax shining very dark brown, humeri pale yellowish. Prescutum with dorso-central rows of dark hairs. Pleuræ dark brown, grey dusted. Scutellum dark brown, metanotum paler with dark brown lateral margins.

Abdomen black, unmarked, slightly shining, with dark hairs. Male genitalia dark brown, female ovipositor with valves long, yellowish.

Legs : coxæ and trochanters blackish, remainder pale yellow brown, tips of femora and tarsi slightly darkened.

Wings uniformly grey, stigma absent. Subcostal cross-vein at tip of vein First vein ending free, though a line of hairs and a depression in the membrane shows its course to the margin and the position of the absent marginal cross-vein near its tip, half way from tip of prefurca to tip of upper branch of second vein. Prefurca hardly larger than upper branch of second vein. First sub-marginal cell nearly as long as second, which is as long as first posterior. Four

posterior cells. Discal cell as long as second posterior. Anterior cross-vein in line with basal section of third vein, at upper basal angle of discal cell : posterior cross-vein at nearly half length of latter. Halteres pale, capitella blackened.

Long 4·5 to 5·5 mm.

Described from four males and two females taken as follows :—two males and one female in deep shade, Shillong, 15th October 1920, one male Cherrapunji, 18th October 1920 : a pair *in cop.* (type and allotype), in shade, Shillong, 20th October 1920. All in my own collection. The much longer discal cell sepatesra it from *parvicellula*, Brunetti.

LIMNOPHILA MULTIPUNCTIPENNIS, sp. nov. (Plate XV, fig. 6.)

♀ . *Head* greyish brown, occiput and frons with an indefinite median darker stripe. Antennæ, scapal joints blackish, large, flagellum pale brown with whitish pubescence, very thin, the whole antenna not more than twice as long as head. Palpi blackish.

Thorax bright yellowish brown, prothorax with sides darker and traces of a median dorsal stripe. Mesonotum with well-defined admedian dark brown stripes, which almost meet on the fore margin and run into one another just in front of the suture, where they terminate ; marginal dark brown stripes commencing at half the length of prescutum, and on postscutum broadening out. A very dark triangular median mark on suture. Presuturally dorsocentral rows of short hairs, arising from the middle at the pale stripes. A short brown bar presuturally above the notopleural suture, not visible from above. Pleura pale brown with an indefinite darker stripe from root of fore coxæ parallel to notopleural suture. Scutellum and metanotum dark brown the upper part of latter paler yellowish below the tip of the former.

Abdomen dark reddish to blackish brown, unmarked, anal segment paler. Ovipositor long, base black, tips of valves yellowish.

Legs pale yellow, tips of femora blackened. (Middle legs missing.)

Wings clear with very numerous pale brown spots. Subcostal cross-vein at tip of vein, marginal cross-vein incomplete, not reaching upper branch of second vein, prefurca long, commencing at one-third of the wing, five posterior cells, discal cell about twice as long as broad. Halteres pale brownish yellow.

Long 6·5 mm.

Described from two paratype females neither in good enough condition to be made the ultimate type, taken at Shillong on 2nd October 1920 (at light) and on 6th October 1920, in bungalow. In my own collection.

Very distinct from the hitherto described Oriental species.

RHYPHIDÆ.

Oligomaster zeylanicus,* sp. nov. (Plate XIV, figs. 5, 13.)

. *Head* black, posterior eye margins laterally, sides of frons, lower half of frontal carina, and face, except for a large black median spot, yellow. Occiput and vertex swollen above, with longish hair, black on former, white on latter. Ocelli close together, the mid ocellus much larger than the two upper ones. Frons at widest (at level of antennæ), one-third width of head, somewhat narrowed at level of ocelli, depressed below level of eye margins, the lower half with a median protuberance, across which runs a carina to between roots of antennæ, shining black above, yellow below; remainder of black area of frons grey-dusted. Face, proboscis and palpi with short black hairs, the two latter concolorous with the former. Eye facets all equal. Antennæ as long as the body. Scape dark yellow below, black above, the basal joint rather wider, globose and three times as long as the apical. Flagellar joints black, distinctly paler beneath, with closely set black, bristly pubescence, the inner edges of each joint with very minute microscopic pubescence and about a dozen definite, widely separated, short, spiny bristles, in two or three rows, spaced more or less equidistantly in each row, the rows all close together. First joint about three times as long as broad, the next four times. The remaining twelve joints approximately as long as the second, but gradually and evenly narrowing to apex.

Thorax: neck yellow. Dorsum of thorax shining black with long white hairs. A triangular yellow area, enclosing a small black spot, on fore corners, humeral calli prominent, lobose, black with white hairs, the upper anterior half yellow. Postalar calli yellow. Dorsopleural suture broadly, the propleural and notopleural sutures narrowly, the pteropleuron and spots at base of fore and hind coxæ, yellow: remainder of pleura black. Scutellum and metanotum black, the former with apex broadly yellow.

Abdomen black, first segment broadest posteriorly, with white basal band, the extreme margin, which is produced into small lobes one each side of the metanotum, black, the whole with long white hairs. Second segment narrowest

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* What is probably the female of this species has now come to hand. It differs from the male in that the flagellum is all black above and below, whilst the scape is yellow above in one specimen. The abdominal white spots are much smaller and less prominent. The hind tibial spur is double. In one specimen the hind femora are all black, as in the male, but without the pre-apical yellow ring in the other, the outer third is yellow with black tip. Abdominal segments 6 and 7 and the ovipositor are reddish yellow.

The female differs therefore from Edwards' *O. orientalis* by the reddish sixth abdominal segment and the hind femora always blackened at least on basal half.

Two females, Suduganga, Ceylon, on 12th March and 6th May 1922. In my own collection

apically, with white basal lateral spots. Third to fifth segments with parallel sides, as wide as tip of second segment, with basal lateral white spots, almost confluent medianly on third, entirely so on fourth, widely separated on fifth segment. Sixth and seventh segments swollen, laterally compressed, black except for the apical margin of latter, which is dull brownish. Laterally the second to fourth segments white, as are also the ventral bases of third and fourth segments, remainder of venter black. Abdomen beyond first segment with short hairs, white and black intermingled. Genitalia extremely assymetrical, twisted so that the whole apparatus faces the right side of the insect, the superior claspers white, the lower brownish yellow, the whole covered with white hairs.

Legs: fore coxæ and trochanters yellow, the former with base black. Posterior coxæ and trochanters black, the former of equal length in mid and hind pairs, and with dull whitish depressed areas on mid pair laterally and hind pair latero-posteriorly. Front femora all yellow, mid yellow with basal third blackish, hind all black except a brownish-yellow subapical ring, the extreme tip black. Anterior tibiæ and all tarsi pale whitish, appearing dark owing to closely set setulæ, fore tibia no longer than its femur and shorter than the metatarsus, with a single apical yellow spur. Mid tibiæ with apical spurs double. Hind tibia yellow, its tip black with a single apical spur.

Wings greyish hyaline, the apical third almost imperceptibly darker. Stigma black, a long dark streak through anterior cross-vein, and some suffusion over apex of discal cell. Venation as described by Edwards for *O. sackeni*, but the lower branch of fifth vein practically straight. Halteres pale whitish, the anterior margin of the shaft with a fan of bristles basally, and shorter, more widely set bristles exteriorly. A line of very short bristles on capitellum, not terminating at the tip.

Long (without antennæ), 8 mm.

Described from a unique male in good condition (one antenna and one foreleg damaged), taken on window, Suduganga, Matale, Ceylon, on 10th August 1921. Type in my own collection.

Whilst it is possible that this is the male of *O. orientalis* (Edw.), there are so many points of difference, especially in leg coloration, that I feel justified in describing it as new. It is twenty-four years since the still unique type of *O. orientalis* was taken; and in several years collecting in this bungalow the presently described species has hitherto failed to make an appearance, so the chance of obtaining a pair *in cop.* and settling their identity or otherwise is extremely remote.

In life an extremely good hymenopterous mimic.

TABANIDÆ.

Tabanus kakhyenensis, sp. nov. (Plate XII.)

♂. *Head*: Eyes bare. Frons about eight times as long as it is wide anteriorly, and rather more than one-third narrower at that point. Frontal callus dark brown, very narrow, not touching the eyes, prolonged upwards linearly for two-thirds the distance to the vertex. In some specimens the callus is hardly wider than its extension. Sub-callus dull, paler yellowish white with median, impressed fine line. Frons and sides of face towards eye margins yellow-grey with black pubescence, which is thicker (the frons therefore appearing darker) on upper half of former. Face beneath antennæ grey-white, with no tinge of yellow, smooth. Jowls with long white hairs. Antennæ; first two joints pale brown with sparce black pubescence and black hairs at upper edge of first and along apical margin of second joint: third joint yellowish to reddish tooth blunt but pronounced, with some black hairs at its tip, the four apical annulations darkened. Palpi grey with white pubescence, closely covered on outer sides with black hairs (which may be thinner basally, the palpi then appearing to have a pale base), not very broad basally, and with apex somewhat pointed. The inner sides appear nearly white by contrast.

Thorax: dorsum black, with golden and black hairs intermingled in approximately equal numbers, giving the whole a dull brown appearance, unstriped. The swelling at each end of the suture with longer, black hairs only. Pleura slate grey with long whitish hairs, of which there are also some above the wing roots and on post-alar calli. Scutellum grey, very shortly pale golden pollinose, with black hairs. The apical margin more violet-grey.

Abdomen brown, with black hairs. The first two segments reddish brown, darkening to very dark brown on the posterior half of the third segment and to almost black on the sixth and seventh. Hind margins of the last five segments broadly but obscurely paler brown (with no shade of red in it). These paler margins not always apparent. On hind margins of second to fourth, sometimes to fifth, segments medianly, small, transversely elongate pale spots with white hairs. In some specimens the whole of the first three segments may be bright yellow brown. Venter similar. The first two to four segments red-brown, remainder blackish. All except apical segments with prominent pale hind margins, not always visible.

Legs black, except basal half of tibiæ, which are obscurely brownish; the junctions of femora and tibiæ always, of tibiæ and metatarsi sometimes, reddish. A fringe of short black hairs on posterior margins of femora.

Wings : Foreborder as far as tip of first vein yellowish, both basal cells slightly infuscated, except for a small elongate streak in upper basal corner of first, and two irregularly elongate streaks one each side of the fourth vein just before its fork in the outer corners of the cells. These streaks are more white than hyaline. Base of anal cell slightly yellow tinged. From tip of first vein a dark, often blackish, band extends to the upper (sometimes to the lower) branch of the fifth vein, bounded concavely exteriorly along the upper branch of the third to the tip of its lower branch, and completely covering the first four posterior cells, and the distal area of the discal cell to a varying extent. The depth of infuscation decreases posteriorly, usually becoming hardly noticeable in the fifth posterior cell. In one specimen the depth of the infuscation is much less, and the edges of the band are diffuse, the whole wing, except the tip, appearing yellowish brown with the bases of the first submarginal and posterior and discal cells clear. There are hyaline streaks in this band in the marginal, first submarginal and all posterior cells, all or any of which may not be apparent. Upper branch of third vein with an appendix, lower branch turned down to meet fourth vein considerably before the margin, thus making the first posterior cell petiolate. In one wing of one specimen the cell is closed only in the margin. Halteres yellow.

Long 13·5 to 18 mm.

Described from three females in good condition from Mohnyin Reserve, Katha, on 15th and 19th May 1919, both the specimens of the later date at light ; one female from Pyonchaung, South Toungoo, on 22nd May 1918, and two females from Yanaungmyin, Pyinmana on 3rd and 9th June 1918, all in Upper Burma, and all taken by C. F. C. Beeson, Forest Zoologist. Type from Mohynin, in Forest Zoologist's collection, as are all co-types except one in my own collection.

A male from Pyonchaung, taken at the same time as the female from that place differs considerably from the type female, but is obviously conspecific with one Yanaungmyin female, and so must be the male of this species. The upper and lower eye facets are sharply differentiated, and there are no traces of bands. The thorax shows no differences, but the first three abdominal segments are wholly, and fourth except at the sides, brownish yellow : venter similar. The distinctness and depth of colour of the subapical band of the wing occupies a position intermediate between the very diffuse Yanaungmyin specimen, and the typical specimens from Mohnyin.

This species would, I imagine, be included by Miss Ricardo in her Group V, in her table of Oriental species in *Indian Museum Records*, vol. IV, p. 113,— but it seems most closely allied to *T. nephodes*, Bigot, from the Naga Hills, from

which it differs by the greyish (not red), face and frons, the darker thorax and less distinctly marked abdomen, and the black legs. Miss Ricardo places Bigot's species in her Group VI.

HÆMATOPOTA BEESONI, sp. nov. (Plate XI, figs. 4, 5.)

♀. *Head*: frons yellow-grey with some black hairs below vertex, and some long white hairs between lower outer corners of paired spots and callus. Callus large, shining black, its lower margin evenly curved, its upper produced in the middle somewhat acutely. Paired spots large, barely touching the eyes and callus, unpaired spot small. A large black inter-antennal spot. Upper half of face with a broad black band passing round the antennæ, lower half pale grey with two small black spots in pit-like depressions. Palpi pale yellowish grey, with black hairs on outer sides and at tips, and longer, white, soft hairs basally. Antennæ, first joint yellow with black bristles; second small, cup-shaped, yellow, covered with black bristles; third very dark brown, paler at extreme base, the basal annulation slightly flattened, almost bare, the three apical black and nearly as wide as the tip of the first annulation. The first two joints together are as long as the third.

Thorax dark brown; a median and two subdorsal pale stripes, all stopping just beyond the suture, and, exterior to the latter, post-suturally, a pair of pale stripes which merge into the transversely pale prescutellar area. Shoulders and sides of dorsum pale, the whole with scattered pale silvery-yellow hairs. Pleura pale grey. Scutellum pale basally and darker on apical half.

Abdomen: the first three or four segments reddish-yellow, the apical ones dark brown. There are traces of a narrow median whitish line, only clearly visible on the apical half of the second and on the fourth and fifth segments, with ill-defined small whitish subdorsal spots on the fourth to the sixth segments. Apices of all segments very distinctly whitish. Venter yellowish basally and brown apically.

Legs: fore pair—coxæ grey, femora dark brown with a fringe of black hairs on their inner edges above and below, most noticeable on the apical third below; tibiæ white basally and black on rather more than the apical half, where there are some long black hairs; tarsi black. Middle pair: femora and tibiæ yellowish, the former with some long grey hairs on inner side, the latter with tip broadly brown and a not very well-defined middle brown ring; basal half of metatarsus pale, remainder of tarsus black. Hind pair: femora yellow with fringes of balck hair above and below, strongest below apically; tibiæ yellowish white on basal, black on apical half; metatarsus pale on basal half remainder of tarsus black.

Wings with apical band single, reaching from fore to hind margin, more or less interrupted in second submarginal cell. None of the rosettes very distinct. White apical spots in the first, second, third and fifth posterior cells, interior to which, before the rosettes, is a double row of small spots commencing in the second submarginal and extending to the fifth posterior cell. A zig-zag line, commencing at a Y-shaped fork in upper corner of anal cell, to the axillary region. The ground colour of the wing is much paler basally than apically. Halteres pale yellow with a brown spot on the capitellum.

Long 8 mm.

Described from three females, two in good condition, the third with the antennæ broken, taken by C. F. C. Beeson, Forest Zoologist, after whom I have much pleasure in naming it, at Bondaung, North Toungoo, Burma, the type on 11th May 1918, on the wing, the co-types on 17th May 1918, biting elephants. Type and one co-type in the Forest Zoologist's collection, Dehra Dun, other co-type in my own collection.

This speceis comes in Group III (B) of Miss Ricardo's paper on the Oriental species, but is amply distinct from *atomaria* Wlk. (Borneo) and *unizonata* Ric. (Ceylon Montane Zone) by the black facial stripe of great breadth. The antennæ are very like those of *unizonata*, but that species is larger and has the wing markings much more clear cut.

HÆMATOPOTA DEMELLONIS, sp. nov. (Plate XI, figs. 1, 2, 3.)

♀. *Head*: frons yellow-grey with some pale hairs, the ocular margins white. Paired spots large, touching the eyes and frontal callus, white ringed above. Unpaired spot absent, a median white stripe from vertex half-way down the frons. Callus shining black, its upper margin straight except for a small obtuse median projection, the lower margin produced laterally around the antennæ, and the median inter-antennal black spot contiguous. Face ashy-grey, a pair of black spots above contiguous with the callus on a level with the antennæ, and at level of their lowest point a black fleck on each side. Palpi pale yellowish, with a few black hairs on outer side and at tip, and with long white hairs on outer side, especially basally. Antennæ not much longer than the head, the first two joints shining dark brown with some black hairs, the third paler, greatly incrassated on the basal annulation, almost bare except for a few very short black hairs at its upper basal angle. Joints approximately 4 : 1 : 8.

Thorax dark yellowish grey, almost greenish, with a single median and subdorsal pair of stripes, the two latter fading away between suture and scutellum. Lateral margins of dorsum also pale, the general appearance being

that of five pale stripes on a dark ground. Scutellum pale grey with well marked darker triangular admedian spots separated by a median pale linear area. Pleura darker grey.

Abdomen pale grey with well marked admedian dark brown spots forming a pair of stripes, their fore and hind margins on each segment slightly laterally produced, giving the outer margins a 'scalloped' appearance. Seventh segment all dark. The junctions of the segments very narrowly pale yellowish grey. Venter grey with broad median dark stripe, the segmental junctions narrowly white.

Legs: femora dark greyish brown with pale pubescence. Fore tibiæ pale at base and slightly incrassated in apical black half, posterior tibiæ ringed, the hind pair obscurely, the median pale ring being indistinct. Posterior metatarsi with basal half pale. No noteworthy hairs on the legs.

Wings pale grey, the markings not very distinct. Apical band double, the two halves joined on fore and hind margins. The first rosette only well apparent, but the second and third can be made out. Stigma dark brown. Halteres, stem pale and capitellum dark brown.

Long 6·5 mm.

Described from a unique female in perfect condition from Nova Góa, Portuguese India, taken in September or October 1920, by Major Froilano de Mello, Director of the Bacteriological Institute of that place, after whom I have much pleasure in naming the species.

This species comes in Group V, section B (a), of Miss Ricardo's paper on the Oriental species in *Indian Museum Records*, vol. IV, but is amply distinct from *H. javana* Wd., the only other species to fall into that subsection.

Hæmatopota burmanica, sp. nov. (Plate XI, figs. 6, 7.)

♀. *Head*: frons yellow grey, an indistinct pale line from vertex to unpaired spot, and the ocular margins indefinitely paler. Paired spots hardly touching eyes or callus, unpaired spot small. Callus shining dark brownish black, obtusely produced above medianly, inter-antennal black spot present. Whole of upper half of face with a broad black band (in co-type the upper half of the band is brown, not black, between the eyes and antennæ), lower half of face pale grey with two small black triangular spots. Palpi pale yellowish, with black hairs on outer side and longer pale hairs basally. Antennæ: first and second joints shining yellowish with much black pubescence, third joint dark brownish black, paler at extreme base, which is only very slightly flattened. The first two joints are as long as the third,

Thorax: dorsum dark brown with indistinct pale median and subdorsal stripes, the latter stopping just beyond the suture, and exterior to them a pair of postsutural stripes. Scutellum brown, pleura dark grey.

Abdomen very dark grey, an indistinct pale median stripe and the sides of the segments indefinitely paler. Segmental margins narrowly whitish. Venter dark grey, unmarked.

Legs: fore pair black, coxæ with long pale hairs, and base of tibiæ pale. Mid pair: yellowish, tibiæ ringed, and tip of meta-and last four tarsal joints black; femora with soft pale hairs below and short black hairs at tip making this appear blackened. Hind pair: femora yellowish, darkened at base and tip, tibiæ concolorous, obscurely two ringed, tip of meta-and last four tarsal joints black; femora with a fringe of black hairs, very noticeable apically below, and outer two-thirds of tibiæ black fringed on the hinder edge.

Wings with all the rosettes distinct, the pale markings small. Apical band single, incomplete, stopping in second submarginal cell, there is also a pale spot on hind margin but this is always clearly separated from the band itself. A white ring with, dark centre exterior to the brown stigma. Traces of pale apical markings in first, second, third and fifth posterior cells, and at tip of anal vein in first axillary cell. Two zigzag lines in the axillary region. Halteres pale with brown capitella.

Long 7 to 8 mm.

Described from two females both in good condition, both taken at Bendaung, North Toungoo District, Burma, on 17th May 1918, biting elephants, by C. F. C. Beeson, Forest Zoologist. Type in Forest Zoologist's collection. Dehra Dun; co-type in my own collection.

This species will come in Group VI (F) of Miss Ricardo's paper on the Oriental species. It is very near her *H. hindostani* from the Bababuddin Hills in Mysore, but this species has the legs without noticeable hairs, as have both the other species in this section.

EMPIDÆ.

Tachydromia zeylanica, sp. nov.

♂. *Head* black, frons and occiput covered with shining white pubescence only visible in certain lights. A pair of fairly strong, widely separated vertical bristles, and two pairs of smaller, proclinate, ocellar bristles, the lower the longer, all brown, and an occipital row of bristles, stronger below the upper ones dark, the lower whitish. Antennæ dark brownish, the third, joint nearly three times as long as the first two together, with dark pubescence.

Extreme base of style dark, remainder white, the whole about half as long as the antenna. Proboscis half the height of the head in length, brown, palpi one-third the length of the proboscis, pale yellowish, with a white apical hair nearly twice the length of the palpus.

Thorax dull ferrugineous with minute pale pubescence. Anterior margin of dorsum darkened to blackish, from behind which a broad blackish stripe runs medianly to root of scutellum, towards which it fades into a general darkening behind the level of the wing roots. A chestnut brown subdorsal stripe, hardly reaching the dark anterior area. Pro– and meso-pleuræ ferrugineous, sterno- and hypo-pleuræ darker. From root of front to root of mid coxæ a band of more distinct, white pubescence. Scutellum and metanotum blackish, the posterior margin of the former paler, with an apical pair of bristles. A single, strong, noto-pleural bristle.

Abdomen dull brownish, with traces of ferrugineous laterally, and some sparse pale hairs. A tuft of stiff black hairs ventrally on the apical margin of the last segment. Genitalia swollen, and more blackly shining.

Legs bright yellow. Front coxæ with white pubescence on front side. Front tibiæ and tarsi dark brown, tips of hind tarsi black. The whole with short golden pubescence. Mid femora greatly incrassated.

Wings pale greyish, veins brownish, third and fourth not converging apically. Halteres yellow.

Long 2 mm.

Described from two males in good condition, taken on a hedge in evening at Emelina Estate, Maskeliya District, Ceylon (4,200 ft.), on 12th May 1919. Type and co-type in my own collection.

This species is most nearly related to *T. nepalensis* Brun. but is distinguished from that species by the thoracic pattern and the non-narrowed tip of the first posterior cell. It is the first species of the genus to be described from India south of the Himalaya.

REVISED KEY TO THE INDIAN SPECIES OF ELAPHROPEZA, Macquart.

1.	Thorax shining black	2.
	Thorax brownish yellow	3.
2.	Basal half of abdomen reddish yellow, apical half black ..	*basalis*, Bezzi.
	Abdomen wholly black	*bicoloripes*, Brun.
3.	Abdomen unicolorous, or base pale and apex darker ..	4.
	Abdomen with apex and base pale, middle area, black ..	9.
4.	Occiput blackish	5.
	Occiput yellowish	8.
5.	Tips of fore tibiæ all fore tarsi and last joint of posterior tarsi black. Wings smoky	*fulvithorax*, Wulp
	Legs practically unicolorous. Wings clear	6.

6.	Style thickly pubescent (bottle-brush-like)	*plumicornis*, sp. nov.
	Style normally microscopically pubescent	7.
7.	Thorax with supra-alar and two pleural black spots ..	*notatithorax*, sp. nov.
	Thorax uniformly ferrugineous yellow	*abdominenotata*, sp. nov.
8.	Third antennal joint black	*ferruginea*, Brun.
	Third antennal joint yellow	*distincta*, sp. nov.
9.	Occiput yellow	*nigropunctata*, sp. nov.
	Occiput black	10.
10.	Tips of tibiæ and tarsi brownish	*metatarsata*, Bezzi.
	Legs wholly yellow	*variegata*, Brun.

ELAPHROPEZA PLUMICORNIS, sp. nov. (Plate XIV, fig. 9.)

♂. *Head*: frons and occiput blackish grey. Ocellar bristles long, cruciate, verticals inwardly directed, occipital row fairly strong, all pale. Antenna, first two joints brownish, third, except extreme base, blackish. Style thickly pubescent and nearly twice the length of the antenna, quite unlike those in the other described species, in which it is only microscopically pubescent, in accordance with the generic character. Proboscis and palpi ferrugineous.

Thorax bright reddish ferrugineous, with short pale hairs, unmarked, save for an indefinite arcuate black line in the position which the transverse suture would occupy, if present. Scutellum concolorous, metanotum darker reddish-brown.

Abdomen dark reddish brown with pale pubescence, venter more yellowish.

Legs yellow to tips of tarsi, the outer half of the hind femora slightly darker. Hind tibiæ with a distinct hood-like process on inner side over the metatarsal articulation.

Wings yellowish, the costa strongly ciliate as far as the tip of the first vein, the second vein ending slightly beyond half way between the tips of first and third veins. Anterior cross-vein and fourth vein very weak until the latter is the length of the posterior cross-vein past its junction therewith. Halteres all yellow.

Long 2 mm.

Described from a unique male, in good condition, taken on a hedge at Suduganga, Matale District, Ceylon, on 18th January 1920. Type in my own collection.

Easily distinguished by the 'bottle-brush' plumosity of the style. A female *E. fulvithorax* (v. d. W.) was taken during the same month in the same place, but this species (of which I also possess the male) is amply distinct by the much darker wings, the darkened front tarsi and the bristles on the posterior side of the hind tibiæ, which are apparently absent in my species.

ELAPHROPEZA NOTATITHORAX, sp. nov. (Plate XIV, fig. 10.)

♂. *Head*: frons and occiput very dark brown. A pair of proclinate ocellar bristles, on a level with and exterior to which is an erect bristle on each side. Verticals somewhat forward-directed, occipital bristles very short. Antennæ, basal joints yellow, third blackish, the style twice as long as the antenna. Proboscis and palpi very short, brownish yellow.

Thorax reddish ferrugineous yellow, paler pubescent. A black spot dorsally above and in front of wing roots on each side, and similar ones over roots of mid and hind coxæ. A general darkening on metapleura. Scutellum concolorous, a narrow black basal area. Metanotum blackish, sometimes paler brownish in middle underneath the scutellum.

Abdomen with basal segments yellowish, apical dull blackish, the whole with short stiff dark hairs. Genitalia small (contracted), yellowish.

Legs uniformly yellow. Tip of hind tibia with a pair of strong black curved spines on anterior margin, on posterior margin a sort of flap, outlined in brown, closely appressed to shaft of tibia over the metatarsal articulation.

Wings hyaline greyish, veins yellow. Anterior cross-vein and fourth vein weak from base to about the length of the posterior cross-vein beyond its junction with the latter. Ciliation of the costa strong as far as tip of first vein or a little further. The second vein ends exactly midway between first and third. Halteres, stem yellow, capitellum blackish.

Long 1·5 mm.

Described from two males in good condition, taken on a window at Suduganga, Matale District, Ceylon (1,386 ft.), on 29th May 1919, and 12th September 1920. Type and co-type in my own collection.

ELAPHROPEZA ABDOMINENOTATA, sp. nov.

♀. *Head*: occiput and vertex black, the latter with greyish shimmer; face more greyish. Occiput somewhat swollen. Vertical and ocellar bristles procumbent. Antennæ, first joint pale yellowish, second and third dark brown, the former with apical setæ, the latter pubescent. Style one and a half times as long as antenna, moderately pubescent. Proboscis half height of head, brownish yellow, palpi white, with some apical hairs, incumbent on proboscis, and half its length.

Thorax shining ferrugineous, unmarked, dorsum very slightly darker in shade. Pleura, scutellum and metanotum concolorous, except for a small black area on metapleuron between base of halteres and side of metanotum.

Abdomen first three segments pale dirty whitish yellow, a pale greyish brown spot at extreme edge of dorsal margin on second and third. Remainder

of dorsum brownish, with short pale pubescence. Venter uniformly pale dirty whitish yellow.

Legs yellow, anterior tibiæ and tarsi and hind tarsi slightly darkened, also junctions of posterior femora and tibiæ. Fore coxæ with two basal bristles on front margin, mid femora with a preapical bristle and the underside with short spiny bristles, mid tarsi with strong, short, black spines and an apical tooth. Hind femora on upper side basally with three strong bristles, otherwise only with soft hairs above and below : tibiæ with two strong bristles equidistant from one another and each end of the joint.

Wings hyaline, costal cilia rather long and widely spaced as far as end of first vein, beyond which they are shorter and more closely set. Second vein ending at one-quarter to one-third of distance between first and third. Halteres pale yellowish

Long 1·25 mm.

Described from a unique female in good condition, taken on window, Suduganga, Matele, Ceylon, on 23rd August 1921. Type in my own collection.

Elaphropeza distincta, sp. nov.

♀ . *Head* yellow, frons narrow but distinct. Ocellar triangle with two pairs of bristles, one erect, one porrect. Verticals two pairs, the inner small, converging, the outer long, nearly parallel. Proboscis short, yellow ; palpi whitish with subapical black bristle, not as long as proboscis. Antennæ wholly yellow, the third joint short, not much more than twice the length of the second. Style yellow with the usual microscopic pubescence.

Thorax and scutellum uniformly yellow, the latter with a pair of strong parallel apical bristles. Metanotum dark with middle area ferrugineous.

Abdomen yellow, the apical half of dorsum with brown patches, the tip upturned, anal lamellæ yellow, small.

Legs uniformly pale yellow.

Wings clear, the tip of second vein nearer that of first than of third. Halteres yellow.

Long 1·5 mm.

Described from a unique female in good condition, taken on window, Suduganga, Matale, Ceylon, on 12th September 1921. In my own collection.

Elaphropeza nigropunctata, sp. nov.

♂ . *Head* yellow, the very narrow frons more brown. Ocellar bristles strong, proclinate, verticals strong, widely separated, erect. Between the ocellar triangle and the vertex are two pairs of small proclinate bristles. Occipital

row situated well behind eyes, fairly strong, ending in a strong genal bristle. All bristles yellowish. Antennæ, the two basal joints yellow, the third dark blackish brown, with extreme base more yellowish. Proboscis and palpi yellowish.

Thorax bright ferrugineous yellow, unmarked dorsally, but with a large black spot on hypopleura. Scutellum and metanotum concolorous, the former with a large black spot occupying all but its lateral margins, the median area of the latter broadly brownish-black.

Abdomen with segments 1 to 3 and 5 and 6 whitish yellow, the fourth segment nearly as long as the first three together, black with pale hairs. Genitalia dark brown above, ventrally yellow.

Legs yellow, front tibiæ and tarsi, mid tarsi, processes at tips of hind tibiæ, and last four tarsal joints, very slightly browner. Hind femora with about seven strong yellow bristles basally above, and about four short black spines on underside subapically. Hind tibiæ with two strong bristles towards middle of posterior margin, and their apex produced behind the articulation of the metatarsus on inner side into a short blunt process. Hind metatarsus somewhat incrassate, with two longish bristles on inner side before the middle.

Wings faintly tinged yellowish, the costa strongly bristled as far as the end of the first vein, whence their length decreases to normal ciliation a little way beyond the tip of the second vein, which is situated at one-third the distance between the tips of first and third veins. Halteres yellow, capitellum elongate.

Long 2·5 mm.

Described from a unique male in good condition, taken on the wing round flowers at Maskeliya (*circa* 4,000 ft.), on 23rd February 1919 (G. D. Austin). Type in my own collection.

PHORIDÆ

Aphiochæta flavifacioides, sp. nov.

♀. *Head*: frons yellow, grey dusted, with scattered short black hairs, face antennæ and palpi all bright yellow. Ocellar tubercle distinct, black, the two upper ocelli dividing the vertex into three approximately equal lengths. Frontal groove weak but distinct. All bristles black. Verticals two, situated midway between edge of eye and upper ocellus on each side, strong, divergent: upper frontals four, in a straight line, lower frontals in two pairs, the bristles of each side approximated to one another and to eye margins, the inner pair slightly lower, inclined inwards towards one another, very little above the

level of the upper proclinate pair, which are much larger than, and very slightly exterior to, the very small lower pair. Arista dark brown, minutely plumose.

Thorax bright yellow with black pubescence, stronger and thicker towards the sides and hind margin of the dorsum, leaving a broad median stripe which appears a brighter yellow viewed from behind; some indefinite infuscation, medianly before root of scutellum which is slightly darker yellow, bare. Pleura very pale whitish yellow, bare. All bristles black, a humeral, three notopleural close together, an anterior supra-alar,—(these four in a straight line gradually ascending posteriorly)—two posterior supra-alar, the anterior very small and in a line with outer edge of base of scutellum, the posterior very strong, on hind corner of dorsum; a prescutellar dorso-central pair and a subapical scutellar pair, these last two pairs somewhat erect. Metanotum black, with some brownish tinge towards hind margin.

Abdomen: dorsum and sides very dark brownish black, second and third segments broadly dull brown basally, venter as far as sixth segment bright yellow: seventh and eighth segments small, all black, except extreme dorsal base of former, brownish, and hind margin, pale greyish, dorsally and laterally. Ovipositor small, yellow, hairy.

Legs pale yellowish white, hind femora black at tips and hind tarsi slightly darkened. Mid tibia with a single long spur, hind tibia with two spurs, of which one is half the length of the mid spur, the other very small.

Wings clear, veins yellow. Auxiliary well distinct, downcurved into first at half the length of the latter, third ending at middle of wing, the fork wide, first discal evenly curved, second and third bisinuate, the former strongly, fourth straighter, all reaching the margin. Costa with a very strong basal bristle, then about six very small ones, and about seventeen rather widely spaced bristles of considerable length. Halteres yellowish.

Long 1·25 mm.

Described from a unique female in good condition at time of description, now headless, taken at Cherrapunji, Khasia Hills, on 18th October 1920. In my own collection.

Separates at couplet K K of Brunetti's table of Oriental species on the yellow venter.

PHORHYNCHUS CINCTIVENTRIS, sp. nov. (Plate XIII, figs. 3, 6, 7.)

♀. *Head*: vertex, frons and face at sides shining black, centre of face, and some mottling on lowest quarter of frons, orange. A vertical row of four bristles in a straight line, two, admedian, below lower ocellus, two, exteriorly

at centre of frons, four in a curved row, its convexity downwards, at two-thirds length of frons, and a median pair, their bases closely approximate, just above epistomal margin, from which there runs an impressed line between these bristles on lowest quarter of frons. An occipital row of bristles and a very strong genal pair, the shorter anteriorly, the longer posteriorly directed. All bristles black, the frontal all reclinate. Eyes minutely pale pubescent. Antennæ, palpi and proboscis orange. Antennæ with third joint very large, hiding the others, pyriform, acuminate, slightly infuscated at tip. Arista long, bare, of two joints, the first minute, basally brownish, remainder black. Palpi with two strong bristles at tip, lower edge with two strong bristles towards tip and a basal row of quite small bristles. Proboscis as in generic diagnosis, slightly darkened towards tip above.

Thorax with dorsal margin very square-cut. Dorsum black, postalar calli yellowish, with closely set black setæ. Pro-, lower half of mesopleuron, and pteropleuron, black, upper half of mesopleuron grey pruinose. Sternopleuron yellow, hypo-and meta-pleuron yellow with white pruinosity, the front margin of former with a large spot of black contiguous with the same colour on pteropleuron. Anterior spiracle prominent, pale. Two propleural bristles, a humeral, a notopleural, two supra-alar and one post-alar and a prescutellar row of six, all strong and black. Scutellum black, bare, with four strong black marginal bristles, the outer pair situated midway between base and inner pair. Metanotum dull black.

Abdomen: basal segment dull yellowish, hind margin with a whitish band, narrowed at centre of dorsum. Second to fourth segments black, fifth yellow, sixth black with extreme hind margin yellowish, seventh and eighth seemingly forming part of the ovipositor, the former with hinder margin very narrowly pale, and each with a lateral bristle. Ovipositor cylindrical, acuminate, slightly chitinized, pale yellowish white, with two long bristles on dorsal margins towards the base, and an apical ring of long hairs, the whole organ covered with small bristles.

Legs: front pair throughout yellowish white. Posterior coxæ yellow—(the hind coxæ are partially concealed by the very incrassate hind femora)—mid femora and tibiæ pale yellowish, tarsi darker, really owing to more closely set setulæ. Hind femora with rather more than basal half yellow, outer half and extreme upper edge, which is shortly pectinate, throughout black. Hind tibiæ yellow, but appear black with extreme base only yellow owing to the very closely set setulæ; hind tarsi yellowish. Anterior coxæ bristly at apices, front tibiæ with a single bristle on anterior edge towards the middle, posterior tibiæ with a similar bristle and three apical spurs. All

tarsal joints with apical bristles, and front metatarsus and posterior first two tarsal joints with a longitudinal row of small bristles in addition. The whole of the legs, except coxæ, minutely black setulose.

Wings yellowish-grey, the apex very slightly infuscated. Venation as in *P. ater*, but the third and fourth discal veins are hardly bisinuate. Halteres pale yellow.

Long 5·5 mm.

Described from a unique female, in good condition, taken flying round a bush in the Royal Botanic Gardens, Peradeniya, Ceylon, on 23rd May, 1920.

Type in my own collection.

This peculiar genus seems to be confined to Ceylon.

TRYPETIDÆ.

Mellesis polistiformis, sp. nov. (Plate XV, fig. 9.)

♂. *Head* dull brownish yellow, frons exceeding in width one-third of head, paler yellow, vertex brownish with short while pile, ocellar triangle black. Below triangle, to middle of frons, runs an indefinite, very slightly darker bar, caused by there being a pair of admedian patches of almost imperceptible pale pile with a few very short white hairs. At middle of frons a transverse, irregular brown spot near eye margin on each side, prolonged inwardly as a narrow streak, but not meeting in the middle. Junction of face and frons at level of antennal roots with an elongate brown spot between eye margins and suture. Frontal lunule darkened. Face distinctly convex, almost yellow, knobbed immaculate, except for a brown transverse stripe along epistomal margin, the ends of which are upturned to meet antennal grooves. A brown spot at lower corner of eye at junction of parafacialia and genæ. Facial suture with a row of short pale hairs. Bristles golden brownish : verticals two, ocellar wanting, upper orbitals wanting, lower orbitals two pairs, the upper reclinate, at level of and exterior to mid frontal spots, lower proclinate, inwardly directed, in line with highest point of lunule, both pairs small. Lower middle area of frons with some scattered short brown hairs. Genal bristle strong, occipital row short, of a few bristles only. Antennæ dark yellow, arista black with yellow base. Palpi yellow, with a few pale hairs, proboscis brown.

Thorax reddish yellow, with short golden pubescence on dorsum and whitish hairs on pleura. Transverse suture broadly interrupted towards the middle, its anterior side with a pale yellow stripe crossing posterior half of mesopleuron and ending as a yellow spot on upper edge of sternopleuron.

Hypopleural spot, large, pale yellow, single, above it an indefinite dark spot each side of the brown metanotum. Scutellum pale yellow, very narrow. Chætotaxy greatly reduced,—only posterior notopleural, two post-alar and two scutellar bristles, all brownish yellow.

Abdomen strongly pedunculate, with apical segments clavate, reddish brown with thick covering of golden hairs. First segment with its bilobed base and its apex paler yellowish, second with median paler stripe on posterior half and paler hind margin, third darker medianly, and with a fan of strong yellow bristles laterally, fourth and fifth with anterior margins blackened. Sides and venter unmarked, save for a paler yellow area laterally on second segment. None of the abdominal markings well defined, the colours shading into each other. Genitalia small, dark brown, retracted.

Legs brownish yellow, bases of posterior femora and tibiæ and all tarsi paler, whitish yellow. Fore femora with three long strong black spines below mid tibiæ with a single strong black apical spur.

Wings yellow, fore margin above fourth vein intensely so, axillary region clear. A subapical triangular black spot, based on costa between tips of second and third veins, with apex in middle of first posterior cell midway between the tips of the cross veins. Second section of fourth vein straight, second basal cell about four times as long as wide, first basal cell ciliate above second. Anterior cross-vein in line with tip of first vein, beyond middle of discal cell. Anal cell with its apex enormously drawn out, its tip hardly more distant from the margin than is the lower end of the posterior cross-vein. No supernumerary wing lobe. Halteres pale yellow.

Long 9·5 mm.

Described from a unique male in good condition taken at Sukna, 500 ft. (base of Eastern Himalayas), (H. A. Inglis) on 4th December 1920. In my own collection.

Bezzi's original definition of *Mellesis* (*Bull. Ent. Res.* VII. 114) would exclude this species on account of the spined fore femora, but in his more recent key to all the genera of the *Dacinæ* (*Phil. Jo. Sci.* XV. 415), he admits species with spinose femora to the genus. In favour of this species being correctly located here are the interrupted transverse suture, straight fourth vein and absence of acrostichals; against it is the convex face, as in *Monacrostichus*, Bezzi. However it has more affinities with *Mellesis* than with the latter genus, though in some respects it forms an annectant link between them. In Bezzi's table of Indian species of *Mellesis* it separates on the spined femora refusing to fall into either portion of couplet 1 (4), possessing as it does characters contrary to either line of the couplet.

Enderlein (*Zool. Jarhb. Jena, Abt. Syst. Zool.* XLIII. 336-360; 1920) has recently described *Polistomimetes minax*, gen. et sp. nov., from Sikhim, the descriptions of which I have been unable to consult. Until the 'Higher Command' of Zoology makes a definite pronouncement in regard to the acceptance or otherwise of post-war German work I feel justified in describing without reference to it.

STAURELLA LUTEIFASCIATA, sp. nov. (Plate XIV, fig. 2.)

♀. *Head*: vertex yellow, frons concolorous, its middle below slightly brownish, with a black, diamond-shaped patch, its upper angle truncate across a line just touching the lower edges of the posterior ocelli, between which the black area is slightly produced upwards, its lateral angles at the upper fronto-orbitals, and produced above them obliquely to eye margins as brownish ill-defined streaks, its lower angle just above the level of the middle pair of lower orbitals. Face concolorous, strongly concave, epistome prominent. Genæ concolorous, also lowerf hal of occiput, the upper half of which is black, save for a vertical lunulate yellow area continuous with the vertex and extending somewhat below the postverticals. Antennæ with first two joints yellowish, the third with extreme base concolorous, the remainder orange, three times as long as the second joint, with tip acuminate. First joint apically setose, second with the whole of the upper surface bristly. Arista brown, basal joint more orange, very short plumose. Palpi yellow with four or five strong bristles. Ocellar bristles absent, verticals strong, inner pair parallel, outer divergent, postverticals parallel. Orbitals 1 : 3, the upper erect, the lower porrect and inwardly directed. The uppermost lower orbital is on a level with, but external to, the upper orbital. The distance from the uppermost to the middle lower orbital is twice that from middle to lowest. Occipital row weak. Genal strong. All black. Eyes in life purple, with green bands in the form of a Maltese cross.

Thorax chestnut brown. Dorsum flattened, with fine black hairs. A median pale yellow stripe, narrower anteriorly, from suture to apex of scutellum, evenly broadened, so that on the scutellum, which is concolorous with the thorax, it occupies the middle third. A black admedian stripe starting from a black patch above the scapular bristle, interrupted over the posterior half of the presutural area, and again broadened out from dorso-central bristle to posterior margin, not continued on to scutellum. From just within the upper posterior supra-alar to level with the dorso-central a short, subdorsal brown stripe. Pleura chestnut brown, the dorso-pleural suture with a yellowish-white stripe from humerous to wing root, anteriorly broadened to cover all the former, and slightly so towards the latter. Metanotum dark castaneous with

median black stripe. Bristles black; humeral 1, noto-pleural 2, presutural wanting, dorso-central present, supra-alar 3, mesopleural 2, pteropleural strong, sternopleural strong. Scutellum with two basal and two apical bristles, all strong and parallel. Its upper surface is flattened like the thoracic dorsum.

Abdomen castaneous brown, the sides of the dorsal surface of the first three segments black, the base of the fourth slightly more broadly, and the whole of the fifth except a median bar and the extreme hind margin, also blackish, but the markings on the two latter segments only visible when light falls on them from the side. Venter paler brown, a median black stripe broadly on first two segments and the hind margin of the fifth darkened. Ovipositor as long as and concolorous with abdomen, circular in section, as broad as last segment basally, apically acuminate, with a black band all round the tip.

Legs uniformly yellowish. The bristles of the fore femora strong above, fewer and weaker below.

Wings: stigma brownish yellow. From just beyond tip of first vein a marginal dark border, much broader apically, shortly but definitely interrupted at tip of third vein, extends to middle of second posterior cell. Over posterior cross-vein and last segment of fifth vein a dark stripe, broadened around upper end of cross-vein and on wing margin. A very faint infuscation, rounded over lower end of anterior cross-vein. Anal cell slightly shorter than second basal, anterior cross-vein at more than half the length of the discal cell. Base of third vein with about five bristles. Halteres yellow.

Long, with ovipositor, 6 mm.

Described from a unique female, in perfect condition, taken on window, Suduganga, Matale, Ceylon, at dusk on 17th August 1921. In my own collection.

This species fully accords with the generic diagnosis, save for the acuminate tips of the antennæ, agreeing with *S. nigripeda* in the position of the anterior cross-vein.

Staurella zeylanica, White.

In my description of this species I was in error in stating that the third vein possesses only two basal bristles. This is so as regards the lower surface, but the upper surface has the vein bristly to beyond the anterior cross-vein.

This would make the species run out at *Ptilona* in Bezzi's key, but it is excluded from Wulp's genus by the presence of the dorso-central and the number of orbital bristles. The head, too, is slightly wider than high. As it agrees with *Staurella* in thoracic chætotaxy I leave it therein, in spite of the bristles of third vein being at variance with Bezzi's definition of his genus.

RIOXA PUNCTATIPLEURA, sp. nov. (Plate XIII, fig. 4.)

♂ ♀. *Head* yellow, a median brown facial spot above epistomal margin. Antennæ and palpi concolorous, proboscis brown. Verticals two, postverticals parallel or slightly diverging, orbitals 2 : 1, but there may be adventitious smaller bristles above and below the lower. The upper superior orbital much shorter than the lower. Ocellar absent. All yellow. Occipital row of thin, pointed, yellow bristles.

Thorax yellow, with pale pubescence except over black areas. A presutural sub-dorsal ovate black spot, a post-sutural dorso-central black bar, interior to which with its tip in line with the tip of the bar is an elongate black spot, which may be fused with the bar, thus making its anterior end spatulate. Before root of scutellum the end of the bar is in-curved, and between the two ends on each side there is sometimes a median brown spot. Sometimes the two in-curved ends and the median spot fuse to form a complete cross-bar, when the post-sutural thoracic markings all unite into a U-shaped mark. Pleura yellow, a large black spot on anterior margin of mesopleuron, another occupying most of central area of sternopleuron, another the lower half of pteropleuron, and another on the hypopleuron. Mesopleural bristle single, pteropleural strong. Scutellum pale yellowish, six bristled, the middle pair weaker and the apical pair crossed. All thoracic bristles yellow. Metanotum with sides and centre pale, and sub-dorsal broad dark brown bars.

Abdomen yellow with pale pubescence. Third, fourth and fifth segments with basal black bands more or less interrupted at the middle of the dorsum the band on second segment often weak or absent. Ovipositor brown with yellow apex, about as long as last two segments.

Legs all yellow.

Wings with three oblique yellowish grey bands, the first from tip of the subcostal vein slightly zigzag over tip of second basal and anal cells, fading in axillary region ; the second starting broadly on the costa before the tip of the second vein, and running obliquely over anterior cross-vein into discal cell ; the third starting on the costa about half way between tips of second and third veins above, and from tip of fourth vein below, running over posterior cross-vein and fading away in third posterior cell. Subcostal cell and extreme base of wing yellowish. Veins yellow, the second through the middle band, the fourth beyond posterior cross-vein, the latter, and the basal cross-vein, black. First vein bristly to tip, third vein to midway between anterior cross-vein and tip.

Long 5·5 mm.

Described from 2 males and 3 female paratypes, none of them in good enough condition to be regarded as the ultimate type, taken in Colombo in July, November and December 1914. In Colombo Museum and my own collections.

This species does not belong to *Rioxa, sens. strict;* but that genus is now, as regards the Oriental forms, merely an assemblage of species awaiting the specialist for proper dismemberment.

In the generic definition Bezzi (*Mem. Ind. Mus.* III. 111), states that the cephalic bristles should be black, but proceeds to add to the genus the *stellata* group, in which some of the frontal bristles are yellow. Edwards adds to the genus *flavicans*, exhibiting a totally different wing pattern, but his description is insufficient, as it is silent on the subject of bristle coloration (*Jo. F. M. S. Mus.* VIII. 50). The presently described species also has the wing pattern different from the species included by Bezzi, and further is at variance with generic characters in the single mesopleural and strong pteropleural bristles, and the shortened anal cell. The all yellow head bristles are quite exceptional. Against its belonging, however, to Bezzi's second section of the family, which divides on this character, are the spiny third vein, pectinate arista, six-bristled scutellum, and a wing pattern which is equally at variance with *Tephrella* and *Tephrostola*, the only two possible genera which could receive it.

The publication of new species in all families, as they come to hand, which is the purpose of the present series of papers, is only justified from the systematic point of view in that it calls attention to the many aberrant forms which the Indian Fauna produces, and provides Specialists with material on which to build up a sufficient knowledge for proper generic conception in their particular groups. Unless a new species is so totally at variance with all known genera that it utterly fails to fall into one of them in its widest sense, the erection of new genera in such papers is, to my mind, quite unjustified and a hindrance to the specialist, hence I leave the present species in *Rioxa*, contenting myself, as I have done in other instances, with pointing out its discrepancies from the generic definition.

Tephritis tribulicola, sp. nov.

♂♀. *Head* yellow, frons wider than one-third of head, slightly narrowed below, varying from pale lemon to dark orange yellow, usually darker in ♀, with a darker luniform mark, convexity upmost, across its middle, from centre of which projects a short line towards the ocellar triangle, and occasionally towards the antennæ also,—this mark often not being apparent in the darker specimens. Ocellar triangle darkened. Face pale, in some specimens almost

white. Antennæ yellow, the basal joints paler, with black bristles, the third joint bare, one and a half times as long as the second, rounded apically, with bare arista, which has the rather enlarged first joint orange, the second black. Bristles : verticals strong, the inner pair parallel, the outer divergent, brown ; postverticals parallel, very pale yellow, not much longer than the adjacent bristles of the concolorous occipital row ; fronto-orbitals 2 : 3, the upper brown, the lower black,—(the type ♂ has an adventitious fourth lower bristle on one side between the upper and lower sets) ; ocellars strong, black ; genal strong, brown. Parafrontalia with short white hairs, only visible from above ; lateral epistomal margins with black, and genæ with white hairs. Palpi and proboscis yellow, the former with short black apical bristles.

Tephritis tribulicola.

a, Larva in hibernating condition, natural size and magnified (×6½).
b, Fly, natural size and magnified (×6½).

Thorax : dorsum yellow, the whole of the disc with an oblong black patch, leaving only all the margins yellow, the black colour extended forward on the mid-line to the neck as a black stripe, and incised at the suture, and, triangularly, on hind margin between the prescutellars, which stand on its hinder edge. These markings are only clearly visible in rubbed specimens, in fresh ones the dorsum is too thickly covered with very pale rather broad hairs, and in life appears olive green. Four small black spots at the insertions of the dorso-centrals and prescutellars. Pleura from pale to dark yellow, sterno- and hypo-pleura with large black spots covering most of their lower halves, that on the former with a patch of pale hairs. Scutellum equilateral triangular yellow, darkened basally. Metanotum with a transverse yellow area immediately below the scutellum, the remainder black, with a linear black stripe running from below across hinder edge of metapleura, in front of root of halteres and posterior stigmata, to upper margin of hypopleura. Chætotaxy complete,

two mesopleural; ptero- and sterno- pleurals strong, black, other bristles brown. Scutellum four-bristles, the apicals parallel and as strong as the subapicals, all brown.

Abdomen: dull yellow, with whitish bristles, appearing olive green in life. In the male the basal margins, dorsally of the second to fourth segments is very indefinitely darkened, the fifth has basally two admedian and on each side a marginal black spot, well distinct. Lateral margins of third to fifth segments strongly bristly. In the female the bases of all the segments are often blackened, but in unstained specimens the fifth and sixth (sometimes also the fourth), show a pair of basal admedian black spots, of which those on the sixth may be confluent. Fifth segment with lateral, sixth with lateral and dorsal hind margins with strong bristles. Male genitalia yellow, the type (taken *in cop.*), has a coiled concolorous tubular process, as long, if unrolled, as the whole abdomen, which is of an increased diameter apically, otherwise normal, small. Female ovipositor as long as the preceding four segments, brown, with black pubescence and tip, strongly flattened dorso-ventrally.

Legs: uniformly pale yellow.

Wings: hyaline, lightly brownish infuscated as follows:—stigma (outer edge of which is often considerably darker); very indefinitely over upper outer angle of second basal cell; over anterior cross-vein, at tip of second vein; and with apex more definitely blackened. In addition there is a brownish band commencing on costa midway between tips of first and second veins, interrupted in first posterior cell, and continuing along posterior cross-vein. Anterior cross-vein not much beyond middle of discal cell, and only very slightly distad of tip of first vein. The cross-veins not parallel, the posterior sloping slightly inwards posteriorly. Anal cell with acuminate point, as long as second basal. Third vein with two small bristles at its origin. Halteres pale yellow.

Long, without ovipositor, 6 mm. Ovipositor 2 mm.

Described from four males and six females mostly in good condition, taken on thistle at Shillong between 25th September 1920, and 7th October 1920, and at Mawphlang on 10th October 1920, by the Imperial Entomologist and myself. Type male and allo-type female taken *in cop.* on the same plant, 7th October 1920. Type and other specimens in my own collection. A considerable number, taken on the same plant at Shillong in previous years, in the Pusa collection seen by me. Except for the non-parallelism of the cross-veins this species agrees well with the genus *Tephritis* Latr., the much reduced wing pattern, however, is very different to its Indian congeners, and is more like *Zonosema* Loew,—but it cannot be allocated to that genus on account of the pale occipital bristles, the costal spine, and the double mesopleural

bristle. In Bezzi's key to the Indian species of *Tephritis* this species runs to couplet 5 and separates from *zonogastra* Bezzi on the very different wing pattern.

In life the species resembles a greenish *Chætodacus*.

Trypanea pentadactyla, sp. nov. (Plate XV, fig. 10.)

♂. *Head*: pale yellow, frons white-dusted, occiput with a black V-mark from vertex to neck. Antennæ, proboscis and palpi yellow, the first with the third joint short, acumitate with black, bare arista of which the extreme base is yellow. Orbitals 1 : 3, the uppermost of the lower range further from eye margins and distinctly darker.

Thorax: dorsum, scutellum and metanotum pale slate grey, the two former with whitish bristles. Pleura greyish, with yellow pollen. Chætotaxy complete, scutellum with two bristles.

Abdomen: grey, with yellowish pollen and whitish bristles. Genitalia small, brown.

Legs all yellow.

Wings: costal bristle very strong. A dark bar from tip of auxiliary vein to middle of first posterior cell, leaving the extreme tip of first vein and first half of costal edge of marginal cell clear. Outer two-thirds of sub-marginal cell are darkened except for a clear dot above the anterior cross-vein and two spots on the costal margin, between which the infuscation is much darker. A circular clear spot on the anterior side of fourth vein, between the cross veins, with a smaller, dark spot in the general infuscation above it, just below the third vein. Obliquely below the tip of the second vein the dark bar splits into five rays, which run to the tips of the third, fourth and fifth veins and between the two latter, two others, equidistantly, to hind margin in second posterior cell. Upper outer corner of discal cell infuscated, an abbreviated ray running from the tip of the anterior cross-vein nearly across the cell. Costa yellow except through the dark areas, with which it is concolorous. Sixth vein stopping short well before margin. Halteres yellow.

Long 4 mm.

Described from a unique male in fair condition, taken at Banhar, North Bihar on 13th March 1921. (*H. A. Inglis*). Type in my own collection.

The much greater amount of infuscation between the tip of the auxiliary and the anterior cross veins, and the upward directed apical ray to tip of the third vein, amply distinguish this species from its two Indian congeners which have the frontal bristles arranged 1 : 3.

DIOPSIDÆ.

Teleopsis bipunctipennis, sp. nov. (Plate XIII, fig. 1.)

♂♀. *Head*: width across tips of eye stalks $2\frac{1}{2}$ times that of thorax in male, twice that of thorax in female. Frons black, ocelli golden, on a somewhat elevated triangle. A subtriangular reddish spot below and exterior to ocellar triangle, eye stalks and occiput reddish, a triangular black area based on eyes extends along eye stalks above until it fuses with the black vertical area, which extends backwards, broadly, to neck, which is reddish. Frons with short black hairs and a long bristle above at inner corner of eye, and divided from face by a black ridge, more distinct in male. Face reddish, with pale silvery pubescence and hairs. Epistome distinct, mouth parts hidden, except yellowish labellæ, which are strongly ridged. Antennæ reddish, second joint with apical margin dark with short black bristles, outer margin of third below the black, bare, arista with pale yellowish pubescence.

Thorax: shining black, with sparse long soft erect hairs. Humeri and pleuræ with pale pubescence. A notopleural bristle, no longer than the dorsal hairs, and a long, strong, supra-alar. Metapleural spine short. Scutellum concolorous, with short black hairs and an apical pair of long, brownish-black spines, each of which bears at its tip a long black bristle, twice as long as the spine itself.

Abdomen: black, shining, the terminal segments in both sexes down-curved and somewhat swollen. Lateral margin with a fringe of short, soft, black hairs. Male genitalia concealed, in female a pair of small yellow lamellæ visible. The membrane between the segments, when exposed as by the down-curving of the apical ones, pale brownish.

Legs: coxæ yellow, fore pair with shining white pubescence on basal half exteriorly. Fore femora reddish-yellow, incrassate, with a row of short black teeth and some longer hairs below, darkened apically, with shimmering white pubescence sparsely distributed over posterior side, and concentrated in a patch at inner edge of apical infuscation on anterior side. The pubescence only visible when viewed with tip of femora towards observer. Posterior femora yellow, with apical third black. Fore tibiæ black, except for the extreme base, yellow, Mid tibiæ basally yellowish, darkening to dark brown on apical two-thirds, hind tibiæ with basal half yellowish, darkening to dark brown on apical half. Tarsi yellowish, except fore metatarsi, which are brown exteriorly, the inner sides thickly furnished with bright golden pile.

Wings: extending beyond the tip of abdomen, infuscated, with sub-apical clear patches in sub-marginal and second posterior cells, the latter immediately

beyond the posterior cross-vein. The infuscation fades to almost clear in the costal and axillary cells. Halteres yellow.

Long: 5 to 6·5 mm. the female distinctly the larger.

Described from five males and seven females, all in good condition, and all taken at one sweep of the net on leaf of a plant growing in the water at edge of the Suduganga river, on 10th August 1919. Most of the insects were on the underside of the leaf, which was not more than six inches above the water.

Type, allo-type, and ten co-types in my own collection.

MUSCIDÆ.

Idiella euidielloides, sp. nov.

♂♀. *Head*: frontalia black in male, very dark brownish in female. Parafrontalia greyish silvery, with a black spot around the base of each frontal. Male frontalia at narrowest about as wide as first antennal joint, female one-fifth of head. Face and epistome shining, very dark brown. Antennæ black, third joint grey-dusted. Arista black with base yellowish. Rays long. Occiput black, genæ yellow with long soft concolorous hairs, at base of each of which there is a small black dot. Proboscis and palpi black.

Thorax: ground colour of dorsum dark metallic green, with grey pollen, closely covered with black dots, from each of which arises short hair. Viewed from in front there are black median and dorso-central stripes, not at all distinct. Scutellum concolorous with mesonotum, the apical margin shimmering silvery. Pleura whitish yellow, with long soft hairs of same colour, arising from small black dots. Chætotaxy: 4 prescutellars—a humeral—2 notopleural—antreior supra-alar 1—posterior 1-3—(the latter on postalar callus)—2 mesopleural, pteropleural weak—sternopleural 0-1, strong. Scutellars 6.

Abdomen: male dorsum shining dark brown, lateral margins of first, second and third at base yellowish brown, of remainder of third and fourth, including tip of the latter, dark metallic green. Female dorsum with all first and basal half of second segment pale brownish yellow, apical half of second third and fourth dark brown, lateral margins and tip of fourth broadly shining, dark green.

Legs: femora black with dark green metallic reflections, tibiæ yellow, apically darkened to a varying extent, sometimes over all the apical two-thirds, first joint of fore, first two joints of posterior tarsi whitish yellow, remainder black.

Wings: costa infuscated in front of second vein, the band extending, subapically, outwards and downwards to bend of fourth vein, fading away

below, the apex, below tip of fourth vein and exterior to it, clear. Squamæ white, margin of lower somewhat darkened. Halteres orange yellow.

Long 5·5 mm.

Described from a pair (type and allo- type), in good condition, taken on a flower shrub, Shillong, 13th October 1920, by the Imperial Entomologist and a female, in indi ferent condition, on a hedge in the native village, Shillong, on 12th October 1920. All in my own collection.

This species has the small facies of a *Euidiella*, and is very like *quadrinotata* Bigot superficially.

EUIDIELLA DISCOLOR, Fab. var. NIGRIPES. (nov. var.)

♂. *Head*: black, parafacialia with some shimmering silver grey spots: lunule and sides of face except for median triangular patches brownish. Genæ yellow with long yellow hairs. Antennæ, proboscis and palpi blackish, third joint of the former grey-dusted. Arista basally yellow, remainder black, rays few and short.

Thorax: dark green with some greyish pollen and very numerous black spots each bearing a hair, scutellum concolorous, its apical margin narrowly whitish shimmering. Pleura yellow, with long concolorous hairs. Chætotaxy humeral 1: presutural 2: supra-alar 2-3: prescutellar 2: notopleural 2: mesopleural in a fan: sternopleural 1-1: usual hypopleural fan. Scutellars 6.

Abdomen: extreme base black. First three segments dorsally yellow, their hind margins black banded, with a median black stripe greatly broadened on the third. Fourth segment silvery yellow-grey, black spotted, hind margin black. A faint median dark stripe.

Legs: fore coxæ dark grey, superficially appearing black; posterior pairs obscurely brownish. All femora black, fore tibiæ black, posterior pairs dull brown. Fore metatarsus and first three joints of posterior tarsi yellowish, remainder black.

Wings: clear, absolutely without trace of infuscation at tip of second vein. Squamæ and halteres pale yellowish.

Long 7 mm.

Described from a unique male in good condition, taken at Emelina Estate, Maskeliya, Ceylon, between 25th and 29th December 1919. In my own collection.

In a long series of *E. discolor* from various localities in Ceylon and North Bihar, I find the yellow fore coxæ and base of hind femora constant, whether belonging to true *discolor* or form *muscina*, Rondani. Normal specimens occurred in company with this specimen, which, further, is distinctly larger than any such seen by me. I give it, until more material comes to hand, varietal rank only.

Euidiella nila, sp. nov.

♂. *Head*: black, parafacialia with some greyish shimmering spots. Antennæ and proboscis black, third joint of former grey-dusted. Palpi dark brownish. Genæ and a narrow postocular margin whitish grey, the former with long concolorous hairs.

Thorax: very dark blue, with a little whitish pollen and numerous black spots, each bearing a short hair. A median and dorso-central black stripes, indistinct. Scutellum concolorous with mesonotum, with apical margin shimmering silvery. Pleura obscurely blackish with greenish brassy reflections, hairs sparse though long, black, whitish above base of fore coxæ and on sternopleuron. Chætotaxy: humeral 1: presutural 1: supra-alar 2-3: prescutellars 4: notopleural 2: a mesopleural fan: sterno-pleural 1-1: a hypopleural fan. Scutellars 6.

Abdomen: dully shining greenish blue, with grey pollen, the first segment dark, blackish. Second and third broadly black banded on fore and hind margins, and with a median black stripe. Fourth segment similar, but basal band, except laterally, and median stripe narrow.

Legs: fore coxæ black, grey-dusted, posterior pairs yellowish brown. All femora, fore tibiæ and tarsi black, posterior tibiæ and tarsi dark brownish.

Wings: clear, very slightly smoky, but not definitely infuscated except around the humeral cross-vein. Squamæ smoky brown, halteres orange yellow.

Long 6·5 mm.

Described from two males in good condition, taken at flowers, Coonoor, on 25th September 1920

Type and co-type in my own collection.

Metallea flavibasis, sp. nov.

♀. *Head*: frontalia brown above, shading to orange at lunule, containing an elongate triangle of shimmering pale golden pollen, the base of which contains the ocelli, its apex reaching half way down frons. Parafrontalia of a similar shimmering pale golden pollen. Frontal width one-quarter of head, slightly but distinctly more narrowed at vertex than in *notata*. Face yellow with a little grey pollen in sub-antennal depression. Parafacialia continuous and concolorous with parafrontalia. Genæ similar, with white hairs. Epistome shining pale yellow, palpi concolorous, with brown tips, proboscis black. Antennæ orange, third joint white-dusted, arista black with orange base, naked. (Under a high power microscopically pubescent). Occiput black on upper, yellow on lower half. A yellow triangle, its base upmost, from vertex to neck. Upper posterior eye, margins narrowly grey.

Thorax: dorsum metallic green, so thickly dusted with yellow pollen as to hide the ground colour entirely unless rubbed, the whole appearing dull olive instead of the bright green of *notata*, with black spots at the bases of the bristles Scutellum concolorous, pleuræ also, but when rubbed the ground colour appears blackish.

Abdomen: first segment pale yellow, sometimes second and third also, or these two segments reddish brown, their hind margins always narrowly pale yellowish banded. Second segment sometimes with subapical transverse brown flecks towards the sides, third segment with subapical black band sometimes obscure, sometimes clear cut and more greyish, fourth and side margins of second and third grey with black spots from which arise bristles. A median black stripe throughout, sometimes absent on first segment, sometimes broadened T-shape sub-apically (in which case the hind margin is narrowly yellow banded as the next two always are), this stripe interrupted where it crosses the apical yellow bands. Venter yellow, with lateral grey spots, small on second and large on third segment. Fourth all grey.

Legs: coxæ dark grey pollinose, femora yellow, their apical halves blackened to a varying width, the extreme tips yellow: tibiæ yellow, the tips more or less darkened: metatarsi yellow, remainder blackened.

Wings clear, squamæ white, halteres pale yellow.

Long 5–6·5 mm.

Described from twenty-four females all in good condition, taken at Suduganga, Matale, Ceylon in January, March, June, August and October of various years, one at fresh cut earth, remainder on windows. Type and cotypes in my own collection.

Amply distinguished from *notata* (v. d. W.) by the yellow bases of the femora and the entire absence of shining green on the abdomen.

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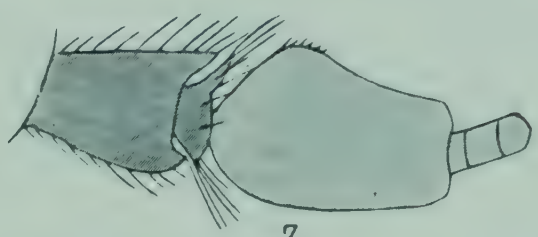

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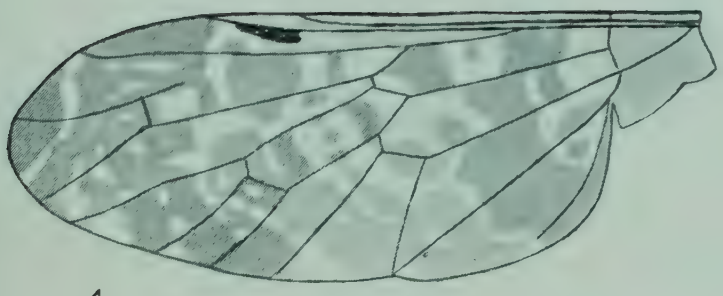

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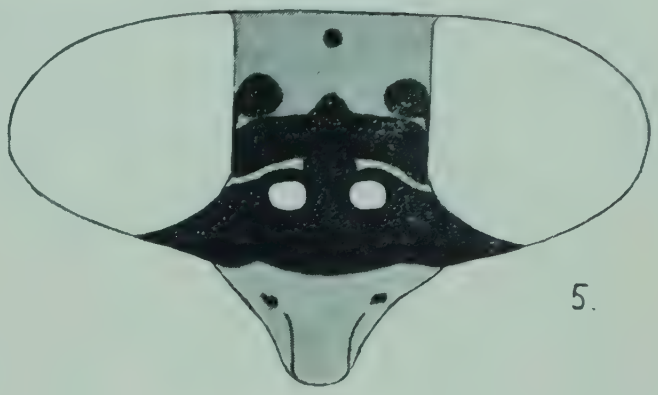

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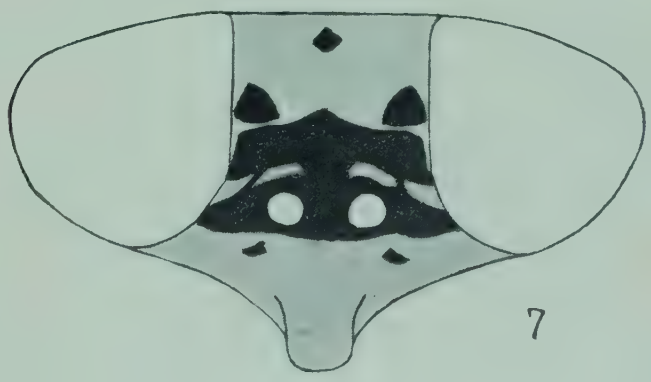

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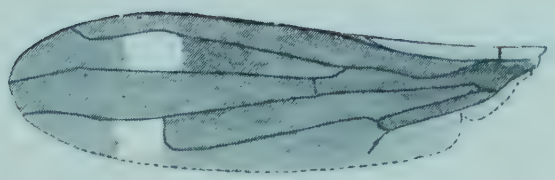
R. S. W. ad nat. del.

Tabanus kakhyenensis. Senior-White.

R. S. W. ad nat. del.

PLATE XII.



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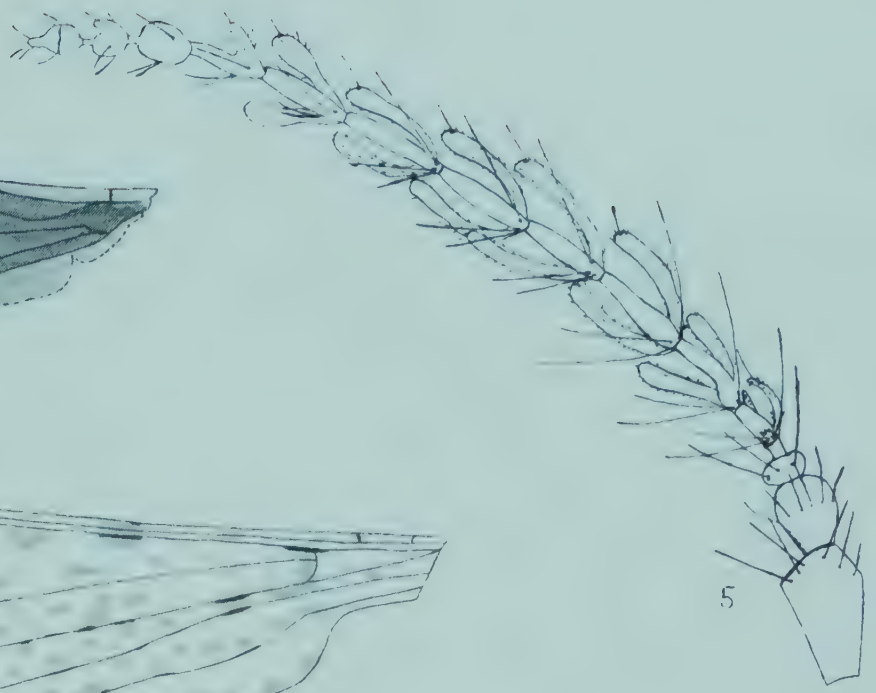

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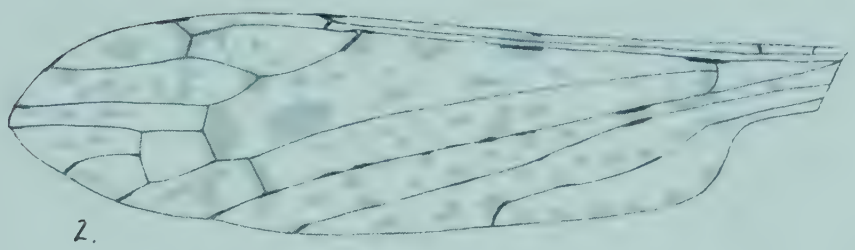

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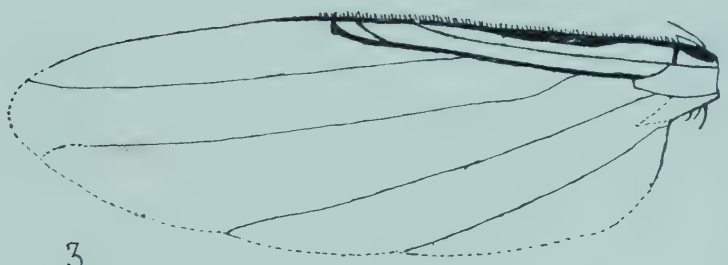

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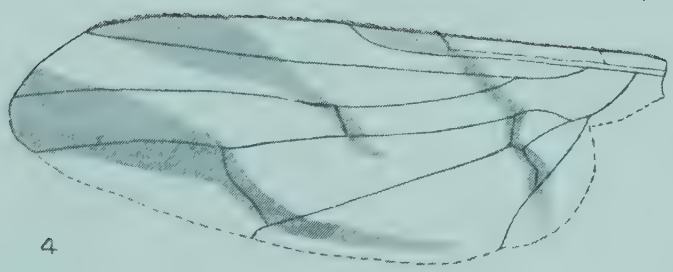

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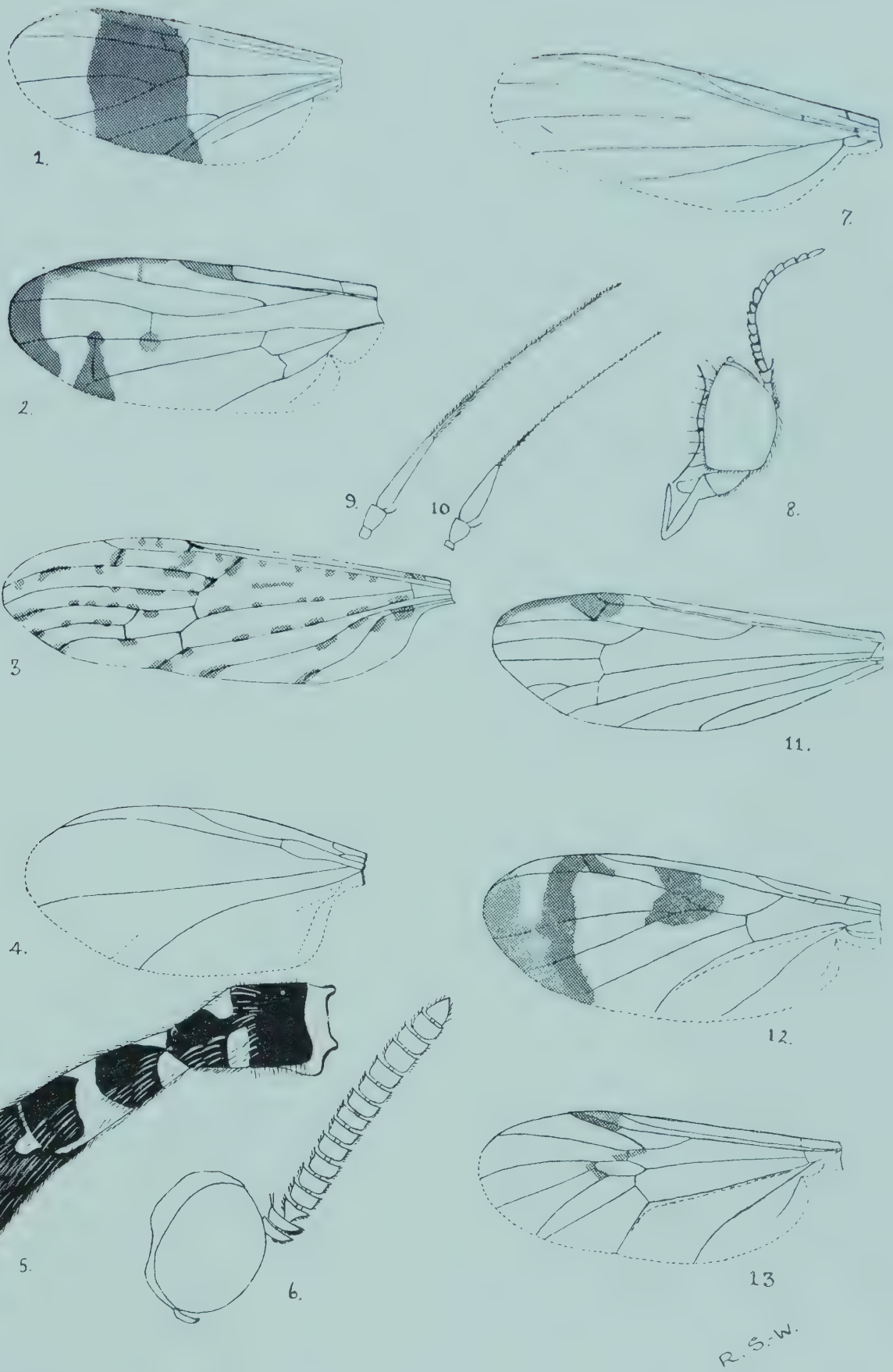

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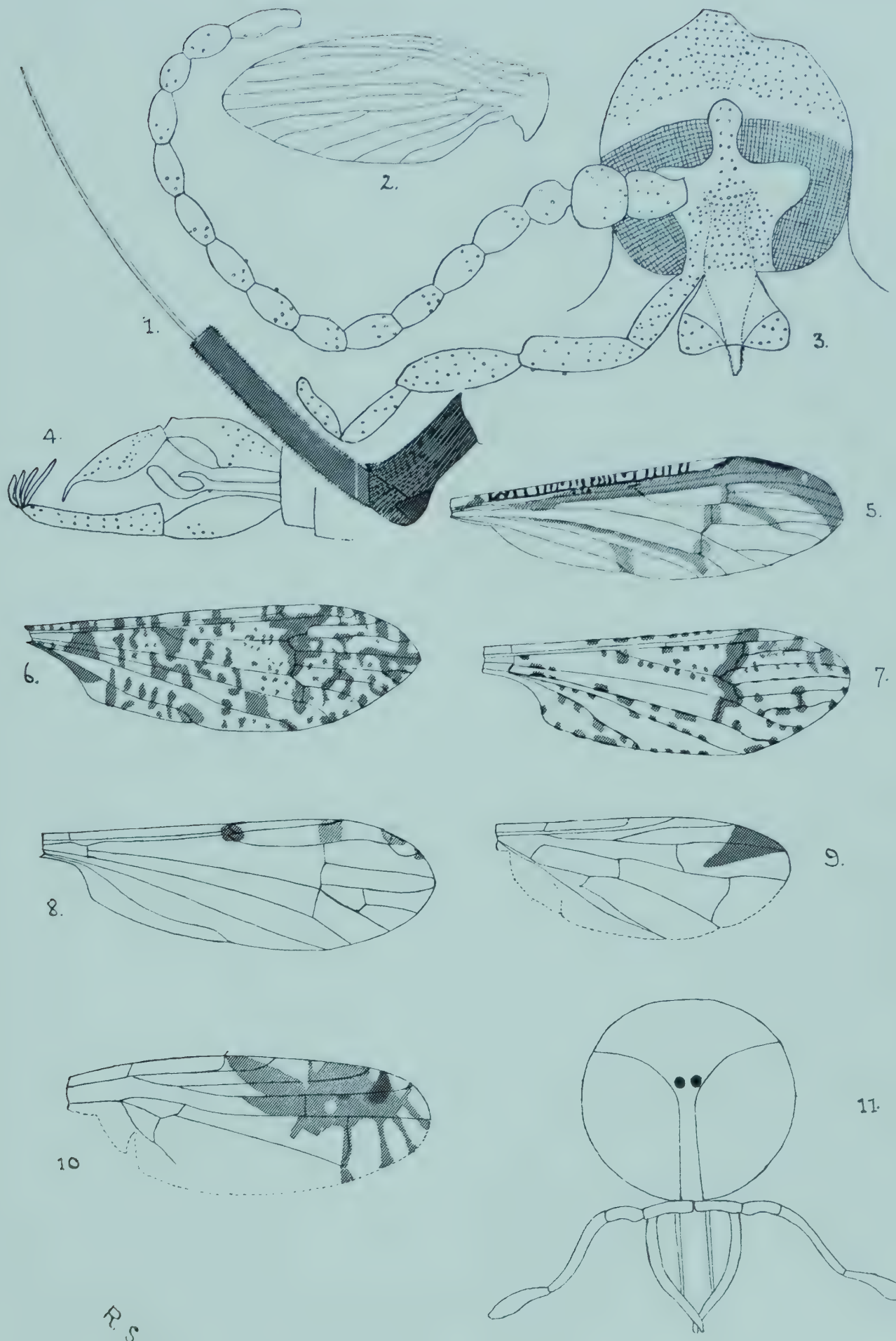

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PLATYEDRA GOSSYPIELLA, SAUND., THE PINK BOLL-WORM, IN SOUTH INDIA, 1920-1921.

BY

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[Received for publication on 4th March, 1922.]

THE investigations into the habits of the Pink Boll-worm for the season 1920-21* were a continuation of those started in 1919.[1] They were designed to act as a check on last season's observations and to find if possible some means of calculating in terms of rupees the actual loss likely to be sustained by the *raiyat*. From this should follow some results which would show the extent to which the Pest Act had benefited cotton growers in those districts in which it has been enforced. As was the case last year, no signs of long-cycle larvæ being produced were found, and the infestation of the new crop must come simply from survivors of the last generations produced in the previous year. The problem of how the Pink Boll-worm tides over the dead season even to the small extent of which it is now capable has yet to be elucidated. This paper only gives figures of the rate of increase once the first infestation of the crop has started.

Measurements were made of all larvæ found in cotton bolls. These were grouped under three heads : those under 5 mm. in length, those between 5 and 10, and those over 10 mm. The percentage of these to one another at any time should give an indication of the rapidity with which broods

* All notes on the Pink Boll-worm and *Earias* spp. refer only to the southern districts of the Presidency as practically no work has been done on these pests in the northern cotton tracts.

[1] Ballard, E. "Results of Investigation of Bionomics of *Platyedra gossypiella* (Saunders) in South India." *Proceedings 4th Entomological Meeting, Pusa*, pp. 70–82, t. 13–15 (Dec. 1921).

succeeded one another. A high percentage of –5 larvæ would show that there had recently been a fresh brood and so on. It seemed last year at one time (27th March–8th May) that the length of the larval life was somewhat prolonged, the majority of boll-worms found in green bolls for these five weeks being between 5 and 10 mm. in length, while later on the generations overlapped considerably; from this it seemed that the larval life during the second part of the season (June–August) was shorter. These observations have not been confirmed by the measurements taken this year (1920-21); no such preponderance of +5 larvæ being found between the same dates. It will be seen from Plate XVI, fig. 1, that generations succeeded one another with equal rapidity.[1] Some attention was given to *E. fabia* and *E. insulana* and notes made on the degree of infestation of green bolls and the amount of damage done by them compared to the amount done by the Pink Boll-worm. The results obtained are given in another part of this paper.

Rate of increase in green bolls.

Last season the increase in boll-worm population was calculated from 1,000–2,000 green bolls examined weekly. This year another plan was followed. A field of about 4 acres was placed at my disposal by the Central Farm. The cotton plants in this were divided up into lots of 100 each and all green bolls from one plot were examined weekly, a different plot being taken each week. It was hoped that by this means a fair average for the whole field would be obtained, and at the same time the amount of infestation for Coimbatore District might be estimated, as it was considered to be unlikely that *raiyats'* fields in other parts of the district would be more badly affected.

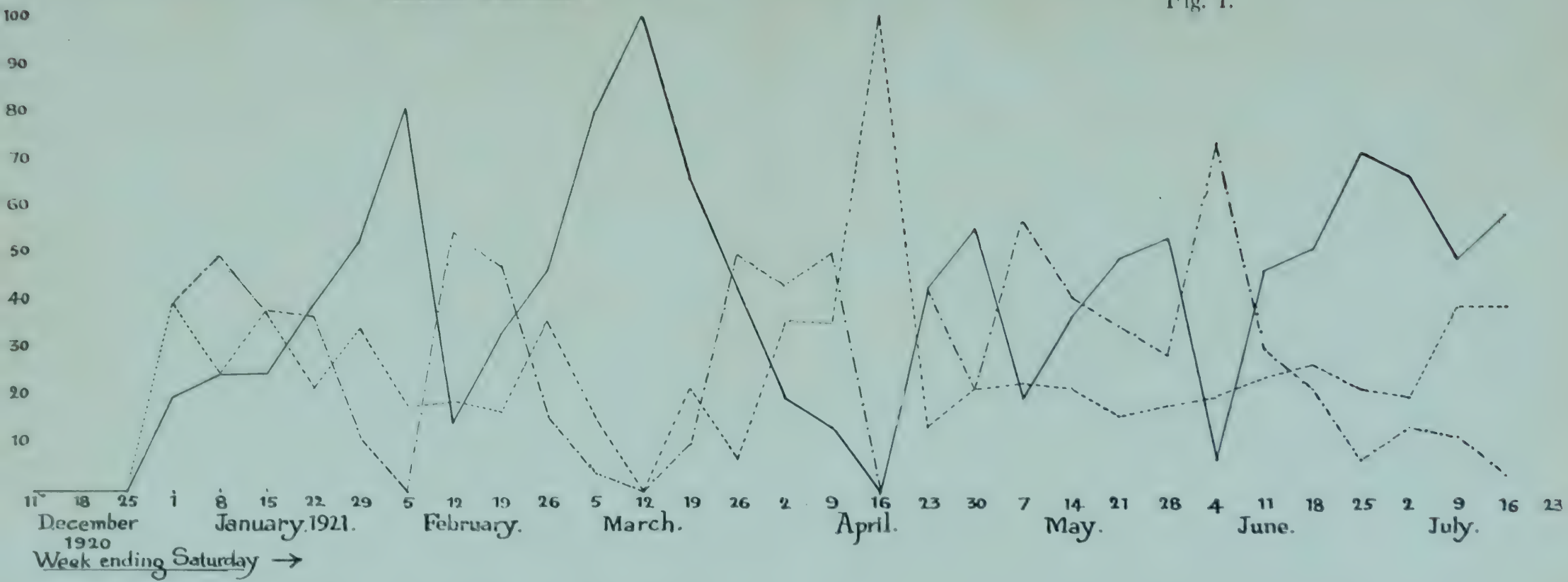
The plants germinated well, but later on in the season did not flourish and very few bolls were set compared with what might be considered a good average field—many of the plots giving a very uneven yield, the highest number of bolls gathered from any block being only 862 for the "season" and 1,412 for the *kar* or summer picking. Plate XVI, fig. 2 gives the degree of infestation week by week and also the increase in boll-worm population. For the purpose of calculating the latter only actual boll-worms found were counted, and reduced to terms of population per 100 bolls. Plate XVII, fig. 1 gives the same calculations from 1919–20 season. The most striking feature noticed, when comparing the two charts, is that whereas last year, towards the end of the season, *i.e.*, after 8-VII-20, the percentage of population was far higher than the amount of infestation, in this year this was not nearly

[1] *Ballard, E. ibid.*

Under 5 mm {-5} ----- Over 5 mm {+5} ····· Over 10 mm {+10} ——

SEASON-1920-1921

Fig. 1.



CAMBODIA COTTON NEW BLOCK CENTRAL FARM

Percentage of population in Green bolls

Earias ····· Platyedra ——————

Percentage of infestation — · — · — · —

SEASON 1920-1921.

Fig. 2.

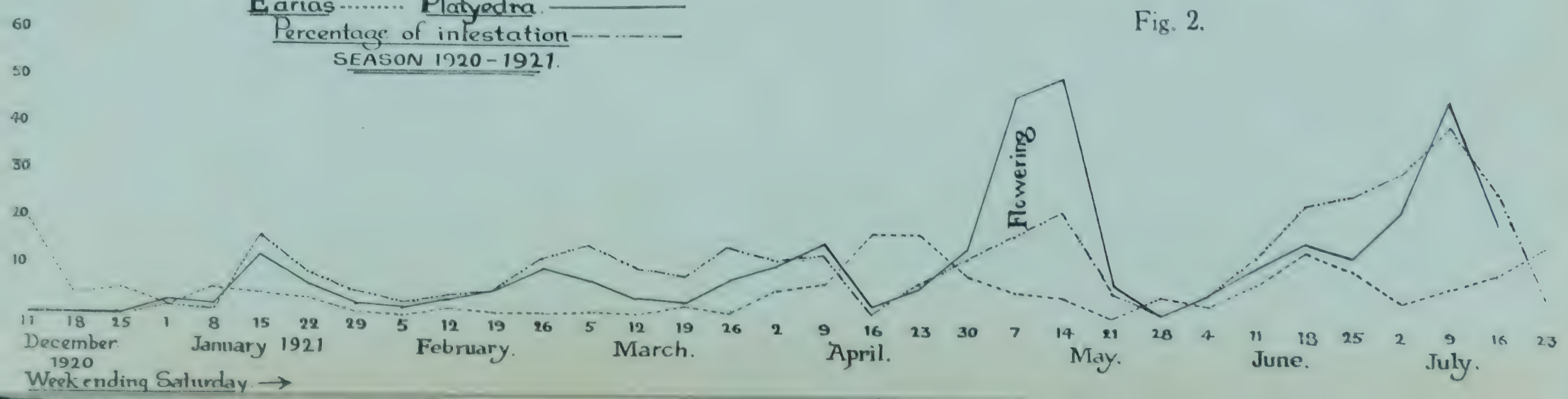


PLATE X

so marked, the population keeping about the same figure as the boll infestation. It is higher during the interval between first and second crops and rises again at the end of second crop, just before plants were pulled up. The infestation for the same week (second week in July) in the two years is the same.

TABLE I.

Number of bolls set by plots of 100 *plants and degree of infestation.*

11-XII-20—23-VII-21.

No. of plot	No. of green bolls	Infestation	Actual population *Platyedra*	Date	REMARKS
		(Percentage.)			
1	35	..	..	11–XII–20	Very young bolls not examined.
6	104	..	..	18–XII–20	First *Platyedra* eggs found on 17-XII-20.
12	76	..	..	25–XII–20	
18	205	2·44	5	1–I–21	
24	178	2·24	4	8–I–21	
30	209	16·74	27	15–I–21	
36	405	8·64	27	22–I–21	From this week green bolls of all ages were collected.
42	770	4·41	17	29–I–21	
48	862	2·43	11	5–II–21	9 larvæ 10 mm. in length.
54	556	5·57	22	12–II–21	
60	709	5·53	39	19–II–21	
66	354	12·14	36	26–II–21	
72	343	14·86	26	5–III–21	
78	235	10·21	9	12–III–21	All larvæ + 10 mm.
84	340	8·82	9	19–III–21	
90	169	14·79	14	26–III–21	
96	255	12·15	30	2–IV–21	
112	195	13·09	14	9–IV–21	84 examined as remainder were eaten by rats.
118	118	1·53	2	16–IV–21	53 bolls eaten by rats. 65 examined.
124	101	7·92	7	23–IV–21	
130	114	13·15	18	30–IV–21	
136	124	17·74	60	7–V–21	34 —5 mm. Maximum number in one boll 11, 10 of which were —5 mm.
142	148	22·97	76	14–V–21	Maximum in one boll 8.
148	648	5·55	51	21–V–21	Maximum in one boll 6.
154	869	2·18	17	28–V–21	
160	1,412	6·30	92	4 –VI–21	69 larvæ—5 mm.
166	604	15·06	71	11–VI–21	
172	343	24 78	59	18–VI–21	
184	593	32·37	140	2–VII–21	92 larvæ +10 mm.
190	300	41·33	141	9–VII–21	Maximum number in one boll 7.
196	106	27·33	23	16–VII–21	Maximum number in one boll 6.
202	108	9·26	7	23–VII–21	Plants all pulled up by 1st August.

After 4-VI-21 young and formed bolls were examined separately. It has been noted that the boll-worm avoids young bolls but prefers those

three-quarters to fully grown. The figures given below support this observation.

TABLE II.

Showing boll-worm population in young bolls and bolls ¾ to fully grown.

Number of bolls	¾ to fully grown	Young	Population	
	a	b	a	b
1,412	470	942	17	3
604	353	251	68	4
349	287	62	56	3
377	357	20	55	..
593	568	25	140	..
300	288	12	141	..
106	57	49	19	4
108	35	73	3	4

DAMAGE TO WHOLE CROP FROM EXPERIMENTAL AREA.

As the crop in the experimental area ripened and picking began, counts were made of the actual damage sustained by the crop. At first the ripe bolls were picked whole from the bushes and brought into the Insectary for examination: later it was found that some were lost and in other cases the *kapas* separated from the capsule. Examination was then made in the field as the crop was picked.

One boll-worm only eats two or three seeds, therefore, as a rule, would only damage one locule, or one lock so far as the destruction of seed is concerned. But in addition to this, the lint is often stained, fungus spores get in through the escape hole made by the mature larva, and threads of the lint are often stuck together. Taking all this into consideration, and also the fact that healthy seeds in an attacked boll are also affected, it was assumed that a locule attacked was to all intents and purposes a locule lost and that its contents were valueless. This is not true in every case and depends on the age of the boll when it was first attacked, but for the purpose of arriving at a rough estimate of the loss to the crop due to Pink Boll-worm it is probably accurate enough. It is calculated that the results obtained give an outside figure and that the actual losses due to Pink Boll-worm fall well inside the estimate made.

In Table III are given the details of examination of ripe bolls from the 4 acres of cotton on the Central Farm, 1920–21. In some ways the figures are unsatisfactory: not only did some stealing of *kapas* take place, but cattle

rom a village just on the boundary of the field, which had been recently acquired, often strayed into the crop and did more damage than many boll-worms. The loss of some *kapas* which fell from the ripe locules also contributes to inaccuracy, but even taking all these factors into consideration the results obtained are not without interest. It may be noted that a boll damaged by *Earias* might at times have been mistaken for one damaged by *Platyedra*, but the effects of the working of the two insects are generally very easily differentiated after a little experience,[1] and it is not likely that very much inaccuracy has crept in owing to the work of the two boll-worms being confused. *Earias* also generally confines its attention to buds and young bolls and in any case is always present in much smaller numbers than the Pink Boll-worm.

TABLE III.

Showing the details of examination of ripe bolls from 4 acres of cotton on Central Farm, 1920-21.

Date	No. of bolls collected	No. of bolls damaged *Platyedra*	No. of locks damaged *Platyedra*	REMARKS
Week ending—				
5–II–21	10,023	4,511	6,300	
12–II–21	8,528	2,692	3,398	
19–II–21	8,596	1,888	2,375½	
26–II–21	13,328	2,369	2,654	
5–III–21	26,904	3,455	3,919½	
12–III–21	25,604	1,728	1,816	
19–III–21	22,469	1,454	1,519½	
26–III–21	11,664	1,071	1,229½	
2–IV–21	8,609	636	730	
9–IV–21	5,340	717	867	
16–IV–21	10,598	2,281	2,102½	
23–IV–21	4,643	1,338	1,346	
30–IV–21	8,050	2,848	3,134½	
7–V–21	3,688	1,504	1,708½	
14–V–21	3,547	1,419	1,665½	
21–V–21	3,693	1,942	2,746	
28–V–21—11–VI–21	Interval between season and *kar* picking.			
18–VI–21	10,970	5,527	9,462	Bolls not picked from West side of field reducing total area by about an acre.
25–VI–21	13,794	4,963	8,088	
2–VII–21	16,776	5,331	8,227½	
9–VII–21	7,617	3,658	6,593½	
16–VII–21	4,876	1,893	3,403½	
23–VII–21	2,402	1,021	2,003	
30–VII–21	793	464	844½	End of season.

[1] Gough, H. L. Nature of damage done by Pink Boll-worm. *Bulletin No. 2, Entomological Section, Cairo* (1916).

Plate XVII, fig. 2 shows the same thing in graphical form, calculated in percentages. From this it will be seen that the percentage of locks destroyed is roughly $\frac{1}{3}$ of the percentage of bolls attacked for the first or season picking, and approximately half for the *kar* picking. From this it follows that for the *kar* picking not only are more bolls actually attacked but also the amount of damage done is proportionately greater for the amount of infestation. Plate XVII fig. 2 also gives the loss due to *Earias*, but that will be referred to again later.

The total number of bolls damaged by *Platyedra* for the season picking was 31,873, out of 1,75,284 bolls collected, that is to say, 12·47 per cent. Out of these 31,873 bolls, with an average of 3·6 locks each (the number of locks in a Cambodia boll varies from 3–5), *i.e.*, 114,741 locks, 36,812 were damaged, that is to say, approximately 33 per cent. of the bolls damaged were a total loss. This makes the damage due to the Pink Boll-worm for the season picking about 4 per cent. As stated above, this figure is, of course, only approximate and represents the maximum loss. It is not claimed that this figure would hold good for the whole Presidency or even for the district as in some parts of Coimbatore the infestation is always lower than on the Central Farm.

For the *kar* picking it was found that the actual loss is a little less than $\frac{1}{2}$ of the percentage infestation. In view of the increase in the boll-worm population as the season progresses some such result might have been expected. For the *kar* picking 57,228 ripe bolls were collected. Of these 22,247 or 39·95 per cent. were damaged by Pink Boll-worm. The 23,857 bolls represent 82,285 locks. Of these 38,622 locks were damaged—this represents 10,728·3 bolls=total loss of 18·7 per cent. or approximately a little less than half the total green boll infestation. The great difference between the loss in the season crop and the *kar* crop is very noticeable. If the *kar* picking is taken as 40 per cent. of the total picking this would mean a loss to the whole crop of 11 per cent. which is probably a fair estimate. It does not however take into account the losses due to *Earias*, or to premature bud-fall due both to *Earias* and to other causes.

A few notes were made on the amount of the food required by one *Platyedra* larva to complete its development. These notes were made in the following way. Attacked bolls were opened and examined seed by seed, the number of seeds totally destroyed was noted, and every escape hole cut was taken as an indication that a larva had been in the boll. The results are tabulated below :—

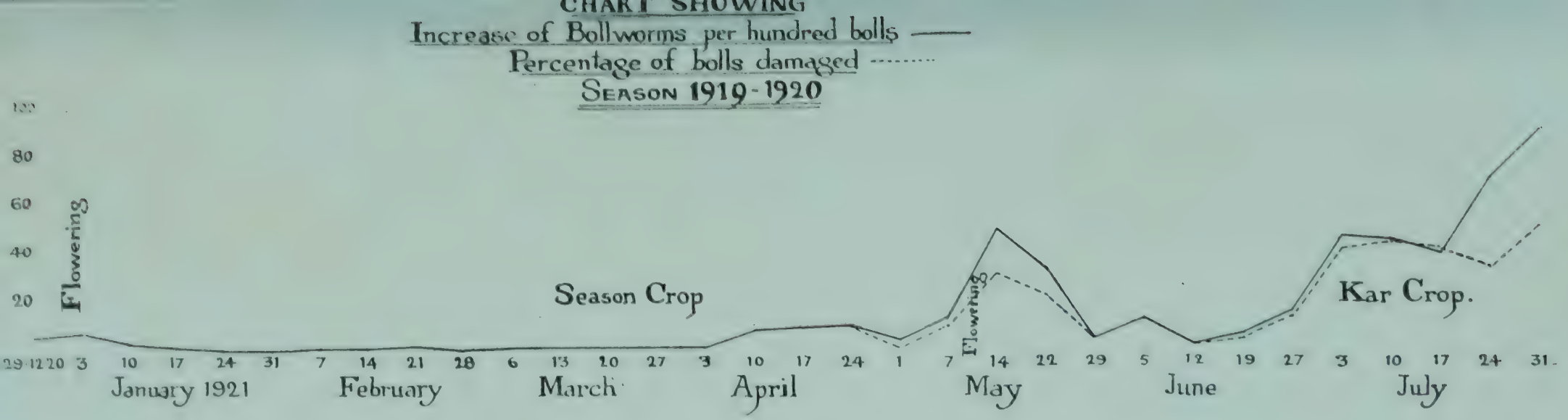


Fig. 1.

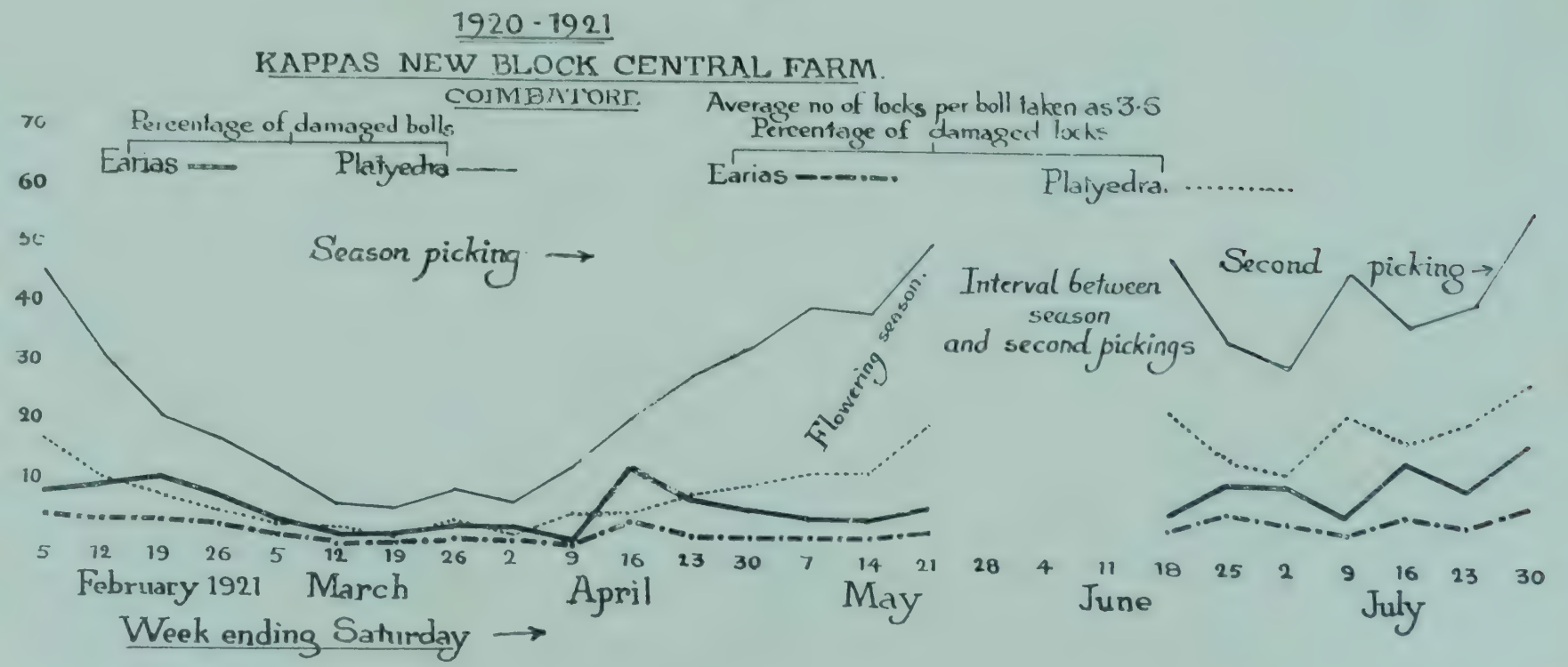


Fig. 2.

PLATE XVII.

TABLE IV.

Showing the amount of food required by Platyedra larvæ for development.

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
1	1 + 10 mm. 1 + 5 mm.	2	4	+	
2	1 + 5 mm.	1	2	—	
3	..	1	4	+	
4	..	1	3	+	2 seeds only nibbled.
5	..	1	3	+	
6	..	1	6	+	
7	2 — 5 mm.	2	2	—	
8	..	2	7	+ (2)	
9	..	3	6	+ (2)	
10	1 + 10 mm.	1	4	—	
11	2 + 10 mm.	2	4	—	These larvæ measured exactly 10 mm.
12	..	1	7	+	
13	2 + 10 mm.	2	4	+	
14	1 + 10 mm.	1	4	—	
15	..	2	5	+	
16	1 — 5 mm.	1	2	—	
17	2 — 5 mm.	1	2	—	
18	1 — 5 mm.	3	9	+ (2)	*Earias* had also damaged this boll.
19	1 + 10 mm.	1	5	+	
20	..	2	6	+	
21	1 + 5 mm.	2	2	—	
22	1 + 10 mm.	1	6	+ (2)	
23	1 + 10 mm.	2	7	+	
24	1 + 5 mm.	½	2	—	One seed only nibbled.
25	..	1	2	+	
26	..	1	3	+ (2)?	*Earias*

TABLE IV—*contd.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
27	..	½	2	+	
28	..	2½	5	+ (2)	
29	1 + 10 mm.	½	1	—	No staining of *kapas*.
30	..	2	5	+ (2)	
31	..	1	4	+ (2)	Also damaged by *Earias*.
32	..	1	2	+	Lock entirely destroyed.
33	1 + 5 mm.	½	1	..	
34	..	3	9	+	Larva had entered from the top of the boll and although over 5 mm. in length had been feeding on boll wall and had only just began to attack the seed. It was feeding free in the lint.
35	..	1½	8	+	
36	..	1	2	+	
37	1 + 10 mm.	2	5	+	Larva measured exactly 10 mm.
38	..	½ + ½	3	+	
39	..	..	..	..	Boll undamaged by larva making cocoon on bracts.
40	..	1	4	+ (2)	
41	1 + 10 mm.	1	5	+	
42	..	½	1 ? 2	+	Boll attacked by Saprophytic fungus.
43	..	1½	4	+3	
44	1 + 10 mm.	1	4	+	
45	1 + 10 mm.	½ + ½	5	+	Larva had made a cocoon by rolling up a leaf in the cage.
46	..	1	1	+	Boll only half-grown.
47	1 + 10 mm.	½ + ½	3	+ (2)	Two holes in two different locks. In one locule two seeds damaged, in the other fully fed larva inside a seed. Suggested that 2nd "Escape hole" was an entrance hole. This in my opinion is very doubtful.
48	..	½ + ½	4	+ (2)	One seed eaten in one locule, two in another.

TABLE IV—*contd.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
49	1 + 10 mm. 1 + 5 mm.	½+½+½	5	+2	3 seeds eaten in one locule, one in each of the others.
50	1 + 10 mm. 1 + 5 mm.	½ + ½	4	—	3 seeds eaten in one locule, one in each of the others. The small larva had eaten through the septum dividing two locks.
51	..	½ + ½	5	+ (2)	
52	..	½ + ½	4	+ (2)	
53	1 + 10 mm.	All	..	+ (2)	Boll was ½ in diameter and completely destroyed.
54	..	2	5	+ (2)	
55	..	½ + ½	2	+? 2	Doubtful whether one or two larvæ had been in hole. But probably only one.
56	1 + 10 mm.	..	4	+	One escape hole half-made, one complete.
57	..	..	5	+ 2	
58	..	..	..	—	*Earias* eating boll rind.
59	1 + 10 mm. 1 — 5 mm.	2	4	—	3 seeds eaten by larva.
60	2 + 5 1 + 10	3	9	+ 4	One lock attacked by fungus.
61	1 + 5	2	2	+ (2)	
62	..	4	6	+ 3	
63	1 + 10 3 + 5 1 — 5	3	9	+ 2	
64	1 + 10 10 — 5	3	9	+	
65	1 + 10 mm.	2	6	+ 2	
66	1 + 5 mm.	1	2	+ 2	
67	6 (-5) mm.	3	6	+	
68	1 (5) mm.	2	3	+	

TABLE IV—*contd.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
69	1 (+ 5) 3 (+ 10)	3	6	+	Whole boll destroyed by *Earias* ?
70	1 + 10 3 + 5	2	6	+	+ 10 larva parasitized ; escape hole half-made.
71	1 + 5	1	2	—	
72	1 (+ 10)	3	9	+ (3)	Larva parasitized.
73	..	4	8	+ (3)	
74	1 + 10	4	6	+	Locks all partially damaged. Larva parasitized.
75	1 + 10 1 + 5	4	6	+ (2)	
76	1 + 5	1	2	—	Seeds attacked but not eaten entirely.
77	..	..	..	—	Attacked by bacteria.
78	1 + 10 1 + 5	3	8	+ (2)	
79	..	..	..	—	Unidentified larva had eaten a large hole from base of boll. No damage inside.
80	..	½ + ½	4	+ (2)	
81	..	1	4	+	
82	1 + 10 1 — 5	2	7	+ (2)	
83	..	All locks showed damage	10	+ (4)	
84	damaged by fungus	4	..	+	
85	..	1	4	+	
86	..	1	..	..	Whole of one lock destroyed either by *Earias or Platyedra.*
87	..	1	8	+	Two seeds were only damaged above the side.

TABLE IV—*concld.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
88	..	2	5	+ (2)	Two seeds entirely destroyed; 3 nibbled seeds completely eaten, each at the top of a locule.
89	..	½ + ½	2	+	
90	..	..	..	—	Small *Earias* just boring in.
91	..	3	8	+ (2)	
92	..	..	..	—	Young *Earias* tunnelling in boll wall.
93	..	1	2	+	
94	..	1	8	+ (2)	Badly attacked by Saprophytic fungus.
95	..	2	4 ? (5)	+	
96	2 +5 mm.	3	10	+ (4)	Do.
97	..	1	4	+	
98	1 +5 mm. 2 +10 mm.	..	..	—	Lost count of seeds.
99	1 —5 mm.	2+½+½	..	+	One larva found just under 5 mm. tunnelling in lint but had not damaged any seed.
100	..	1	3 + 1	..	One damaged by *Earias*.
101	..	1	6	+ (2)	
102	..	½	2	+	Saprophytic fungus in boll.

224 larvæ had destroyed partially or entirely 356 seeds. Of these larvæ 51 were recently hatched or only half-grown. So it would appear that not more than three seeds are required to feed a larva. The average would be about 2, provided that the boll was fairly well-grown at the time of attack. As has been often stated before, *Platyedra* usually avoids young bolls. In this connection it might be noted that *Platyedra* early in the season lays its eggs on flowers and prefers apparently those blooms which are fertilized and beginning to wither. Recently laid eggs were found in fertilized flowers on 17-XII-20. The first boll-worms were not found in bolls until the week ending 1-I-21. At the time when eggs were found on the flowers there were young maturing bolls in the field, but not in any great number (Table I).

Examination of seeds and bolls for the existence of long-cycle larvæ.

Green bolls were collected from the Central Farm on 2-VIII-21. These gave 1,118 moths between 2-VIII-20 and 4-IX-20 of which the great majority came out by 25-VIII-20. In addition to these, two were caught on 20-IX-20.

These bolls were examined on 28-I-21 ; many seeds showed pupal cases either inside them or half pushed out of the hole made by the entrance of the larva. No larvæ were found with the exception of one which was dead.

The remainder were examined on 1-III-21. One double seed was found containing a dead larva, one or two seeds with no larvæ and numerous pupal cases.

There seems to be little doubt that long-cycle larvæ do not occur in South India.

Kapas store Central Farm Summer picking, 1920.

Between 16-VII-20 and 15-VIII-20 a light trap was put in the *kapas* store on the Central Farm. Between 16-VII-20 and 15-VIII-20, 1,335 moths emerged, the highest catch being 138 on 30-VII-20. No more were caught after that date and the store was cleared from *kapas* and seed purchased locally, probably mixed first and second picking. Between 16-X-20 and 2-XI-20, 62 moths emerged, the highest catch on any day being three.

Comparison of attack by *Platyedra* in area under the Pest Act and areas outside its jurisdiction.

The Pest Act was extended in 1920 to cover all Coimbatore District with the exception of Kollegal, Trichengode in Salem District, Karur, Kulitalai and Manaparai in Trichinopoly District, and the *taluqs* of Dindigul and Periakulam in Madura District. All Cambodia cotton was supposed to be pulled up by 1st August. This ideal was not attained but all cotton was out by the end of the month except in those cases where false returns had been submitted.

Arrangements were made with the Deputy Directors of Agriculture to send in weekly consignments of green bolls from different places in their circles. Some 100–300 bolls were sent weekly. The results of the examinations of these bolls are given below (Table V) :—

TABLE V.

(A) *Infestation of bolls from Pest Act area.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual Population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
		Coimbatore District. Avanashi Taluq.				
26-II-21	207	1·96	3	1·44	..	All cotton pulled up after the first picking.
5-III-21	102	3·92	3	·98	..	
12-III-21	103	0·97	..	..	..	
19-III-21	105	6·60	1	1·90	..	
26-III-21	120	6·60	3	4·10	2	
2-IV-21	189	8·31	8	1·14	1	
9-IV-21	110	16·36	8	2·72	..	
16-IV-21	115	30·43	34	2·60	1	
23-IV-21	110	50	42	2·72	1	
30-IV-21	107	41·12	79	4·67	..	
7-V-21	100	43	54	1·00	..	
14-V-21	106	70·75*	287	1·88	2	
		Coimbatore District, Palladam Taluq.				
19-II-21	116	12·06	6	0·86	1	
26-II-21	349	7·26	29	2·24	1	
5-III-21	323	6·40	23	0·98	2	
12-III-21	208	6·70	9	..	..	
19-III-21	422	7·28	10	2·57	4	
26-III-21	212	7·96	9	0·81	1	
2-IV-21	303	9·38	24	2·77	2	
9-IV-21	287	18·86	42	4·04	1	
16-IV-21	289	33·90	106	3·75	4	
23-IV-21	204	41·66	69	9·8	4	
30-IV-21	208	49·12	186	2·38	..	
11-VI-21	101	24·75	15	0·99	1	
25-VI-21	103	17·47	8	6·79	6	
2-VII-21	95	16·84	3	..	..	
9-VII-21	108	39·87	21	5·55	2	Average for Coimbatore District including Central Farm 19·09.

Average infestation for season 19·9 per cent.

* As the season picking is over by this date and there are very few green bolls it is doubtful whether this figure should be included in the average.

TABLE V—*contd.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
			Madura District, Dindigul Taluq.			
12-III-21	96	22·91	33	3·12	1	Bolls from Dindigul and Palani mixed in transit.
19-III-21	50	38·00	33	2	1	
26-III-21	100	24·00	17	5	..	Boll also attacked by *Platyedra.*
2-IV-21	160	36·91	79	0·5	..	One lot of bolls a long time in transit.
9-IV-21	101	70·29	102	2·97	2	
16-IV-21	104	26·29	18	25·96	9	
7-V-21	100	36·00	30	..	..	
14-V-21	101	86·13*	198	2·97	6	
21-V-21	101	37·62	27	..	..	
27-V-21	97	30·92	26	..	..	
4-VI-21	190	46·00	60	..	..	
25-VI-21	99	13·13	5	..	..	
2-VII-21	100	18·5	40	..	..	
9-VII-21	99	58·58	68	..	..	Excluding week 14-V-21 which was abnormal owing to there being very few bolls in the fields from which consignments were collected.
Average infestation for whole season for this *taluq* 45·89 per cent.						
			Madura District, Nilakottai Taluq.			
11-VI-21	100	39	48	2	2	
18-VI-21	100	56	85	3	3	
			Palani Taluq.			
12-III-21	96†	22·91	33	3·12	1	
19-III-21	50	58·00	24	8·00	4	
28-V-21	109	46·78	47	1·83	1	
			Periakulam Taluq.			
12-III-21	99	5·05	3	3·03	2	
19-III-21	101	12·87	2	3·96	4	
26-III-21	100	14·00	13	4·00	1	
9-IV-21	100	48·00	61	6·00	2	
16-IV-21	101	27·72	16	27·72	5	
14-V-21	98	85·71‡	196	8·16	4	
28-V-21	100	29·00	43	2·00	2	
11-VI-21	75	40·00	14	4·00	1	
18-VI-21	100	25·00	18	9·00	7	
2-VII-21	98	30·61	21	6·12	1	

The average for the season for these *taluqs* of Madura District in which the Pest Act was enforced is 39 per cent.

* Picking over, very few bolls in those fields. They do not therefore represent an average attack.

† Bolls from Palani and Dindigul *taluqs* which adjoin were mixed in transit.

‡ Picking over in this field, bolls very few.

TABLE V.—*contd.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent *Earias*	Population *Earias*	REMARKS
			Salem District, Omalur Taluq.			
26–III–21	107	0·93	..	3·73	3	
2–IV–21	109	36·69	43	2·74	2	
			Salem Taluq.			
26–III–21	100	..	..	6·00	1	
12–III–21	110	10·9	4	2·72	2	
			Trichengode Taluq.			
26–II–21	105	1·9	2	..	..	
Average for Salem District 3·85 for months February and March.						
			Trichinopoly District, Karur Taluq.			
9–IV 21	119	36·13	65	2·52	..	These bolls were collected from fields in which picking was in progress. In the vicinity the crop had been removed before May. These figures are not reliable therefore and could not be included when making out general average for area under Pest Act.
21–V–21	250	80·00	202	3·60	3	
			Kultialai Taluq.			
26–III–21	100	4·0	2	13·0	7	Only consignment received from this part.
An examination of a crop was made in this *taluq* in the middle of August. Infestation was 40 per cent.						
			Musuri Taluq.			
2–VII–21	167	34·13	63	2·99	..	Only consignment received from this *taluq.*

(B) *Bolls from* Taluqs *not under the Pest Act.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
			North Arcot District.			
12–III–21	203	49·75	53	1·97	1	
26–III–21	140	25·71	14	0·70	1	
30–IV–21	106	8·49	1	2·83	..	

TABLE V.—*concld.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
			Vellore—North Arcot.			
5–III–21	195	5·04	4	26·15	23	Cambodia cotton only recently introduced.
19–III–21	201	11·44	2	..	..	
30–IV–21	200	32·50	27	4·00	2	
			Madura District, Tirumangalam Taluq.			
12–III–21	200	32·50	30	2·00	6	
19–III–21	200	41·00	131	2·00	13	
26–III–21	200	42·00	108	2·50	10	
2–IV–21	200	48·50	207	3·00	1	
9–IV–21	199	50·25	29	1·05	1	Some larvæ eaten by ants in transit.
16–IV–21	200	32·50	53	0·17	3	
23–IV–21	189	64·02	273	0·52	..	
30–IV–21	200	74·50	424	0·50	1	
7–V–21	200	61·00	171	2·50	5	
14–V–21	200	68·00	191	3·50	..	
21–V–21	195	38·97	49	6·66	1	
28–V–21	200	36·50	61	4·00	..	
4–VI–21	200	29·00	11	3·50	1	
11–VI–21	201	8·45	3	3·98	2	
18–VI–21	200	17·00	4	6·00	..	
25–VI–21	200	14·50	11	6·50	1	
2–VII–21	200	20·50	17	5·00	3	
9–VII–21	200	41·50	62	1·50	..	

Average infestation for season 40·03.

Unfortunately a complete series of bolls was only obtained from one *taluq* outside the Pest Act area. The figures might however be compared with those from the same districts last year when the Pest Act had been enforced only in Coimbatore District.

Date	Area	Attack in 1920	Attack in 1921
		per cent.	per cent.
17–VII–20	Virudupatti, Ramnad District	42·9	34–40
3–VII–20	Dindigul tract	80·9	18·5
5–VI–20	Salem	68·0	No details for this month.

Coimbatore District, where the Pest Act has been enforced since 1919 but which showed boll infestation of 75–84 per cent. in that year, at the end of the season in 1920 showed a maximum of 55·5 per cent., and in 1921 a maximum of 41 per cent. From these figures, although they are not by any means as complete as might be desired, it may be concluded that the pulling out

of Cambodia by a certain date, so as to leave a definite dead season between each crop has been attended by satisfactory results. At Tiruppur, the great cotton ginning and buying centre in Coimbotore District, the opinion of buyers is unanimous that the quality of the cotton since the introduction of the Act has improved. They are all in favour of its being continued. The details of boll infestation not being a complete series from every *taluq*, for purposes of comparison one should select certain weeks and compare them with the same week in other districts and with the same district in previous years.

The actual application of the Act is by no means as satisfactory as could be desired. They are only too many factors calculated to nullify the good effects of its strict enforcement. False returns are sent in stating that all cotton has been pulled up when that is not the case. Sometimes fields sown with Cambodia are not shown in the village accounts, especially if the owner is rich or influential. There is much delay in pulling out the cotton even when it is pulled out and, except in the case of irrigated cotton, it is very rarely that it is out by the appointed date, 1st August. In time, when both the *raiyats* and the Village Officers are accustomed to the Act, its application will be much more efficient. In addition to trouble with the Village Officers there is the usual difficulty created by alarmists who spread wonderful tales as to the real motives which inspired the Act. For example, certain helpful persons, non-co-operators, put it about that the idea of the Act was to restrict the growing of cotton, and to discourage the *raiyats* so that no home spun and woven cloth could be used. The *raiyats* would thus be forced to buy imported cloth. Others had an idea that by pulling up cotton by 1st August plague would be prevented. Others again thought the Government wished to prevent cotton being grown, and there is no doubt that the area of Cambodia cotton was much reduced in some places in consequence. The *raiyat* appears to find it difficult to believe that any Act could be brought in for his own benefit and there are only too many people going about nowadays ready and anxious to provide him with some other theory of the idea underlying the Pest Act, the " Satanic Government " being credited with all kinds of wicked motives !

In spite of all this the continued strict enforcement of the Act is necessary. It may have to be amended in some ways to suit peculiar conditions in different areas. In a country where consideration and mercy are almost invariably looked upon as weakness great care has to be exercised in giving concessions by extending the date by which the crop must be out of the ground so that, when a certain date has been decided upon for a particular tract, the provisions of the Act should be enforced with the utmost vigour. On the whole it cannot be said that the Act is popular with the *raiyats*, but as the majority of them

cannot be expected to know what is good for them, the fact of its unpopularity should not prevent its continuance.

Only one examination of Karunganni cotton (*Gossypium obtusifolium*) was made this year. This was from a field on the Central Farm. 200 green bolls contained 4 larvæ and a 3·5 per cent. infestation. The examination was made on 25-VI-21, when fields of Cambodia were attacked 24–30 per cent.

Earias insulana and Earias fabia.

The numbers of *Earias* spp. in a field at a given time are always very much less than those of *Platyedra gossypiella*. At the same time, an individual *Earias* larva does far more damage than does a Pink Boll-worm. *Earias* larvæ wander from boll to boll, destroy buds and young bolls, and by the holes they make in grown bolls when they attack them, provide an entrance for fungi and bacteria. If *Earias* were as prevalent as *Platyedra* it would be a very serious pest indeed. As it is, in spite of the damage done to buds, tops, shoots and bolls, I do not look on it as a pest of the first order except in certain parts of the Presidency, *e.g.*, in Tinnevelly, where it is a much more serious pest than *Platyedra*.

Table VI shows the relative increase and damage done by *Earias* spp. on the Central Farm during 1920–21.

Plate XVI, fig. 2 shows the same thing in graphical form.

Table VI.

Green bolls from 100 plants.

11-XII-20—23-VII-21.

Plot No.	No. of bolls collected	Per cent. of bolls damaged	No. of larvæ found	Date	Remarks
1	35	34·28	7	11–XII–20	
6	104	4·90	5	18–XII–20	
12	76	5·25	4	25–XII–20	
18	205	2·92	4	1–I–21	
24	178	9·56	10	8–I–21	
30	209	4·78	9	15–I–21	
36	405	6·33	16	22–I–21	
42	770	3·37	4	29–I–21	
48	862	1·50	..	5–II–21	
54	556	2·33	7	12–II–21	
60	709	0·84	6	19–II–21	
66	354	0·84	1	26–II–21	
72	343	1·45	3	5–III–21	
78	235	0·85	1	12–III–21	
84	340	2·64	8	19–III–21	
90	169	1·77	2	26–III–21	

TABLE VI.—*concld.*

Plot No.	No. of bolls collected	Per cent. of bolls damaged	No. of larvæ found	Date	Remarks
96	255	7·05	16	2–IV–21	
112	84*	11·9	6	9–IV–21	195* } Bolls collected, some eaten by
118	65*	18·46	12	16–IV–21	118* } rats.
124	101	23·76	18	23–IV–21	
130	114	12·28	11	30–IV–21	
136	124	8·06	7	7–V–21	
142	148	6·08	7	14–V–21	
148	148	3·39	7	21–V–21	
154	869	7·94	48	28–V–21	
160	1,412	4·10	58	4–VI–21	
166	604	12·25	52	11–VI–21	
172	343	18·07	51	18–VI–21	
178	377	21·48	44	25–VI–21	
184	593	7·41	28	2–VII–21	
190	300	11·33	26	9–VII–21	
196	104	18·66	12	16–VII–21	
202	108	17·59	10	23–VII–21	

TABLE VI A.

Damage done in dry ripe bolls at the time of picking.

Date	No. of bolls gathered	Bolls damaged by *Earias*	Locks damaged by *Earias*	Remarks
		Season Picking.		
5–II–21	10,023	825	1,643½	
12–II–21	8,528	821	1,293	
19–II–21	8,596	942	1,376	
26–II–21	13,328	1,123	1,783½	
5–III–21	26,904	1,085	1,379½	
12–III–21	25,604	287	348	
19–III–21	22,469	464	486	
26–III–21	11,664	346	338	
2–IV–21	8,609	222	233½	
9–IV–21	5,340	51	61	
16–IV–21	10,598	1,427	1,746½	
23–IV–21	4,643	360	481	
30–IV–21	8,050	451	678½	
7–V–21	3,688	197	279½	
14–V–21	3,547	194	288	
21–V–21	3,698	258	421	
		Kar *picking season.*		
18–VI–21	10,970	779	1,500	
25–VI–21	13,794	1,500	3,444½	
2–VII–21	16,776	2,001	3,295	
9–VII–21	7,617	581	1,122	
16–VII–21	4,876	775	1,313	
23–VII–21	2,402	270	503½	
30–VII–21	793	140	251	

Percentage of dry bolls damaged for season picking .. 5·16
„ „ „ *kar* „ .. 10·90

Actual damage .. 12736·5 locks = 3536·8 bolls = 2·01% season picking..
„ „ 11427 „ = 3063 „ = 5·3 % *kar* „

From this it will be seen that damage done by *Earias* is approximately half the green boll infestation as compared with one-third for *Platyedra* for season picking and half for *kar* picking.

On the same basis, taking season picking to be 60 per cent. of the total picking and if the figures for the Central Farm are more or less typical for the District, *Earias* damaged 3·32 per cent. of the total crop compared with 11 per cent. loss due to *Platyedra* or 14 per cent. loss of the crop due to both boll-worms.

All the above figures deal with bolls which had set and ripened. *Earias* does most havoc among buds and very young bolls, and also to the top shoots of the plants, causing in some cases much deformity. In Table VII are given the figures for the number of bolls and buds shed by 100 plants in one plot (No. 86) during the season.

TABLE VII.

Buds and bolls shed by 100 plants in Plot No. 86.

Date week-ending	No. of buds and young bolls	Damaged by *Platyedra*	Damaged by *Earias*	Other than insect agency	REMARKS
11-XII-20 ..	81	..	67	14	The great majority of bolls were young ones of maximum diameter 5 cm.
18-XII-20 ..	66	1	58	7	
25-XII-20 ..	43	..	21	22	
1-I-21 ..	16	4	2	10	
8-I-21 ..	38	2	20	16	
15-I-21 ..	66	4	49	13	
22-I-21 ..	101	3	28	70	
29-I-21 ..	387	3	10	374	
5-II-21 ..	328	5	3	320	
12-II-21 ..	319	3	3	313	
19-II-21	336	3	7	320	

TABLE VII—*contd.*

Date week-ending		No. of buds and young bolls	Damaged by *Platyedra*	Damaged by *Earias*	Other than insect agency	REMARKS
26–II–21 ..		204	1	8	195	Figures for buds and young bolls given separately after this date.
5–III–21 ..	Buds	13	..	4	9	
	Bolls	72	..	4	68	
12–III–21 ..	Buds	26	..	1	25	
	Bolls	85	..	..	85	
19–III–21 ..	Buds	27	..	2	25	
	Bolls	114	..	15	99	
26–III–21 ..	Buds	21	4	5	12	
	Bolls	94	3	24	67	
2–IV–21 ..	Buds	25	1	3	21	
	Bolls	203	..	13	90	
9–IV–21 ..	Buds	3	..	..	3	
	Bolls	54	..	8	46	
16–IV–21 ..	Buds	26	1 ?	11	14	
	Bolls	37	1	12	24	
23–IV–21 ..	Buds	5	..	2	3	
	Bolls	6	1	2	3	
30–IV–21 ..	Buds	19	..	9	10	
	Bolls	34	4	2	28	
7–V–21 ..	Buds	76	13	33	30	
	Bolls	96	16	17	63	
14–V–21 ..	Buds	81	2	55	27	
	Bolls	211	7	107	97	
21–V–21 ..	Buds	125	33	79	13	
	Bolls	515	52	258	205	
28–V–21 ..	Buds	65	..	38	27	
	Bolls	550	20	116	414	
4–VI–21 ..	Buds	58	8	27	23	
	Bolls	414	9	81	324	

TABLE VII—*concld.*

Date week-ending	No. of buds and young bolls	Damaged by *Platyedra*	Damaged by *Earias*	Other than insect agency	REMARKS
11-VI-21 ..	Buds 28	12	12	4	
	Bolls 106	10	20	76	
18-VI-21 ..	Buds 10	1	6	3	
	Bolls 45	5	18	22	
25-VI-21 ..	Buds 5	1	2	2	
	Bolls 38	5	11	24	
2-VII-21 ..	Buds 4	..	4	1	
	Bolls 3	..	2	..	
9-VII-21 ..	Buds 30	1	29	..	
	Bolls 26	8	17	..	
16-VII-21 ..	Buds 87	10 ? *	73	4	
	Bolls 42	1	33	8	
23-VII-21 ..	Buds 45	2	41	2	
	Bolls 23	..	22	1 ?	

* Probably damaged by young *Earias*.

During the season the hundred plants in Plot 86 shed 4,168 bolls and buds. Of these shedding of 991 was due to *Earias* attack and 258 to *Platyedra* of which 11 are doubtful. The remainder dropped owing to bacterial infection or purely physiological causes (Plate XVIII).

SUMMARY.

1. Figures obtained this year seem to indicate that the actual loss sustained by a cotton crop from *Platyedra* during the season picking is $\frac{1}{3}$ of the boll infestation and during the *kar* picking $\frac{1}{2}$.

2. *Earias* is a much less important pest although one larva does more damage than one *Platyedra* larva.

3. Loss due to *Earias* may be roughly estimated at $\frac{1}{2}$ the boll infestation.

4. Examination of entire crop from a field about 4 acres showed the loss due to Pink Boll-worm to be 11 per cent. and *Earias* spp. 3 per cent.

CHART SHOWING

Relative percentages of causes leading to bud and boll fall.
From 100 plants in plot No 86. New Block Central area. Central Farm. Coimbatore.
SEASON 1920-1921

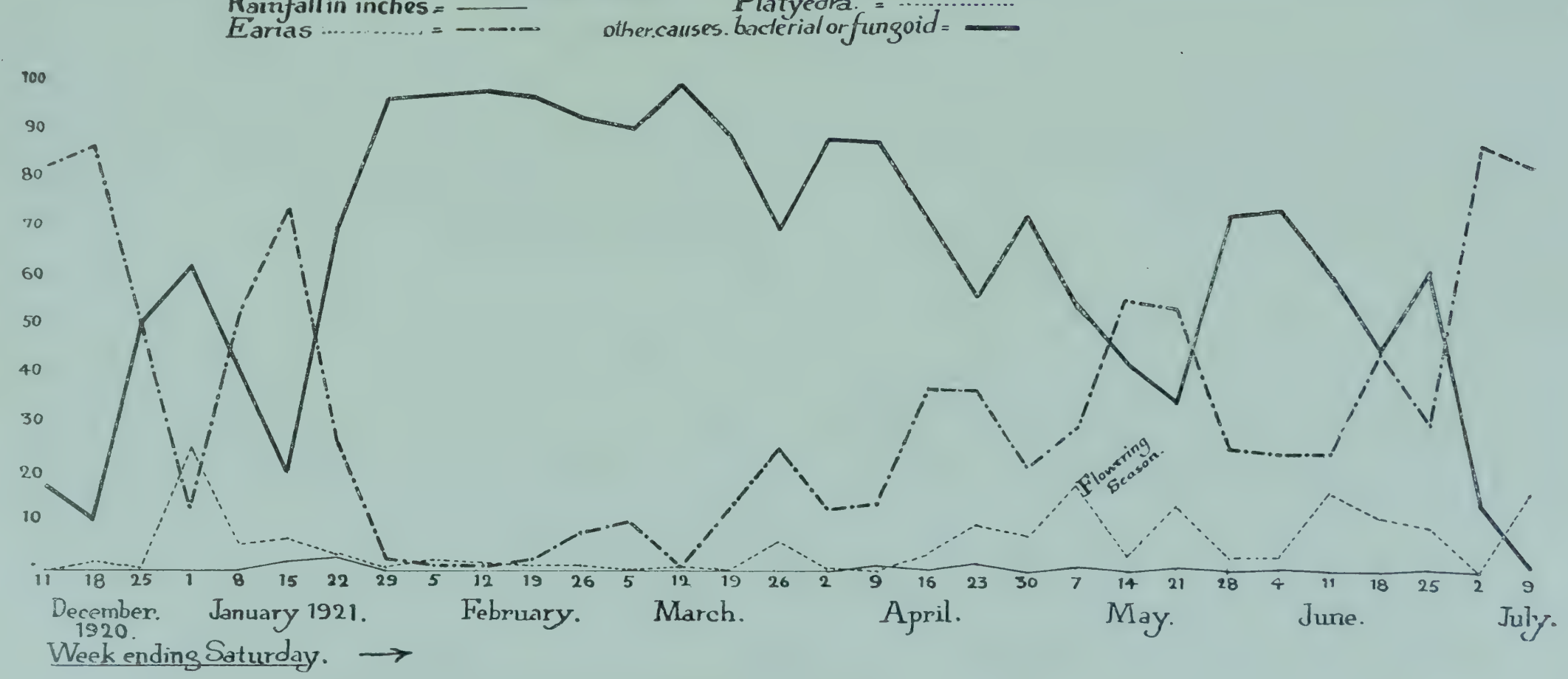


PLATE XVIII.

5. The enforcement of the Pest Act has been attended by good results and should be continued.

6. Figures are given showing how much bud and young boll shedding is due to *Earias* and *Platyedra*.

7. Figures are also given which show that one *Platyedra* larva needs one to three seeds to complete its development.

8. The "long-cycle" *Platyedra* larvæ do not occur in South India.

9. The increase in green boll infestation on Central Farm and in various districts is shown in the tables.

STUDIES IN INDIAN DERMAPTERA.

BY

MORGAN HEBARD.

[Received for publication on the 10th March 1922.]

Recently, all of the undetermined Dermaptera belonging to the Agricultural Research Institute at Pusa, Bihar, India, were sent to us for study by the Imperial Entomologist, Mr. T. Bainbrigge Fletcher. Through his kindness the author has been permitted to retain the holotypes and unique specimens, returning a second set of the material to that Institution.

To the collection to be studied was added material belonging to the author, received from Father C. Leigh, S.J., of St. Joseph's College, Trichinopoly, and from Mr. Andrew Prabala Nathan of Coimbatore, as well as a few specimens belonging to the Museum of Comparative Zoology at Cambridge, Massachusetts. The total forms a larger and more varied Indian series of earwigs than has been studied since Burr prepared his report on Dermaptera for the Fauna of British India.

A great number of localities are represented, evidently situated in many very distinct life zones. It appears, however, that no single locality has yielded more than a small percentage of the total number of forms which there almost certainly occur. This is partially owing to the fact that the collecting of Dermaptera is difficult, due to the secretive habits of the majority of the species and the great diversity of habitat.

Certain species are to be found only under moist bark, others under stones still others in flowers and some in the seed pods of plants or under decaying fruit. Many species are, moreover, comparatively scarce. These factors have resulted, as is usual, in many of the species being represented by uniques or but one or two specimens in the collections before us. Some species, however, come to light and it has often been found more easy to secure large series there than by searching for them in their normal habitat.

Three hundred and ninety-two specimens are here recorded. These represent twenty-nine genera and forty-four species, of which two genera and ten species are described as new. Burr has reported, in all, forty-two genera

and ninety-five species, now recognized as valid, from this territory (which does not include Ceylon or Burma), the present paper bringing the total to forty-four genera and one hundred and eight species. One of the new species here described is not included in this total as it is from Burma. Ceylon and Burma are very rich in Dermaptera, as is shown by the fact that Burr, including these regions in the Fauna of British India, there records fifty-one genera and one hundred and thirty-three species, to which total several subsequent additions have been made.

The territory covered is so vast and varied that it is probable that many undescribed species will still be found. The student must consider undetermined material, however, with exceptional care, owing to the great variability shown by certain species.

In the preparation of the present paper we have been particularly interested in finding that the contrast between the brachylabic and macrolabic phases of certain species is not only manifested by differences in the male forceps but also by changes in the pygidium, ultimate tergite and even by slight differences of proportion in the pronotum as well. As a result, the contrast between the phases developed in such species as *Labidura riparia*, *Exypnus koorgensis*, *Proreus melanocephalus*, *Forficula schlagintweiti*, *Forficula acris* and others, would easily lead one to suppose that in each case two very distinct species were represented. Consideration of the sum total of characters and, in some cases, intergradation proven by large series, has made possible the proper association of the extremes developed in these species.

We have found that, for the majority of the described species, very few and inaccurate measurements have been given. We have, therefore, in the present study, given the essential measurements for many of the less well-known or variable species. These measurements have been taken with the aid of a micrometer. This we find the only safe method of securing measurements sufficiently accurate to show the actual proportions of insects as small as are many of the earwigs.

DERMAPTERA.

PYGIDICRANIDÆ.

Diplatyinæ.

Diplatys bicoloripes, new species. (Plate XIX, figs. 1 and 2.)

This species is closely related to *D. gladiator* Burr, described from Calcutta [and also recorded from Chota Nagpur and Coimbatore, T. B. F.]. It agrees

in having abortive wings, concealed by the tegmina, which are no longer than the width across their shoulders ; in the general cephalic contour ; in the strongly dilated ultimate tergite of the male, and the depressed and dilated male forceps.

It differs in the strikingly bicolored femora, the appreciably concave distal margin of the penultimate sternite and in the forceps, which are quite as strongly bowed as in *D. falcatus* Burr.

In the present insect the forceps have the dorsal surface proximad, toward the external margin, produced dorsad in a stout conical projection ; a feature not mentioned in the descriptions of the two species to which it clearly shows nearest relationship.

Type : male ; Nagpur, Central Provinces, India ; 17th January 1919. (Y. R. Rao.) [Hebard Collection, Type No. 772.]

Size small, form slender, with distal extremity of abdomen much enlarged; as in *gladiator*. Head decidedly wider than pronotum, slightly wider than width across tegminal shoulders ; postocular keels weak, sutures distinct, a weak ridge present on each side of median suture ; occiput flattened, but not at all concave. Antennæ with 19 segments, third segment three-quarters as long as the short first segment, fourth about three-quarters as long as third, fifth intermediate in length between these.

Pronotum very slightly longer than wide ; lateral margins convex and converging very slightly caudad, caudal margin truncate and rounding broadly into the lateral margins ; prozona flattened convex, showing a linear medio-longitudinal sulcus, remaining portions depressed. Large scutellum exposed. Tegmina short, rounded distad ; wings rudimentary.

Abdomen with distinct stink glands, eighth and ninth tergites widening in strongly increasing ratio. Tenth (ultimate) tergite very ample, smooth, roughly hexagonal ; lateral margins weakly concave in proximal half, thence weakly convex (sometimes sinuous) to the depressed and rectangular latero-caudal angles ; caudal margin with lateral portions weakly oblique convergent and showing weak concavity to median third, that portion transverse and weakly concave, the two projections thus formed very bluntly rounded.

Pygidium directed ventro-cephalad, so that its rounded apex lies between the bases of the forceps. Forceps broad and strongly depressed proximad, forming on the internal margin a heavy and very blunt tooth, the forceps attingent only at this point, thence tapering and arcuate so as to enclose a spade-shaped area which is broader than long. The internal margins of the forceps are otherwise unarmed, the dorsal surface of each arm proximad near the external margin, produced dorsad in a stout conical projection.

Penultimate sternite with lateral margins convergent distad, rounding into the rather broad distal portion, which is weakly concave, showing faint angulation.

Measurements (in millimeters).

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of forceps.	Greatest diameter of forceps
Males—						
Type	9·1	1·43	1·43	1·75	1·56	0·95
Paratype	9·4	1·43	1·45	1·65	1·56	0·92
Paratype	9·7	1·43	1·41	1·72	1·40	0·95

Coloration. Type (recessive). Head blackish brown, shading to prout's brown on occiput. Antennæ yellowish, becoming slightly darker distad. Pronotum warm buff, the prozonal portion buckthorn brown, tinged with blackish brown latero-cephalad. Tegmina blackish brown. Abdomen dorsad tawny, becoming russet proximad and there suffused with blackish brown in lateral portions. Forceps warm buff, becoming tawny in distal portions. Limbs warm buff, the femora this color in proximal two-fifths and distal fifth, remaining two-fifths of femora blackish brown, in striking contrast. The homologous portions of the cephalic and median tibiæ show a clouding on their dorsal surfaces of brown. Ventral surface buffy, except on abdomen where it is ochraceous-tawny. In the generally darker paratypes the prozona and meso-caudal portion of the metazona is prout's brown, shading to mummy brown latero-cephalad on the prozona.

In addition to the type of this handsome species, two paratypic males and an immature individual are before us, which bear the same data.

Diplatys lefroyi Burr.

1910. *Diplatys lefroyi* Burr, Fauna Br. India, Dermaptera, p. 44, Pl. I, figs. 5 and 5*a*. [♂: Belgaum, S. Bombay; Shencottah, Travancore.] [Also recorded from Coimbatore, T. B. F.]

Bassein Fort, Bombay, Bombay Presidency, IX, 1909 (A. Mujtaba), two males.

The limb coloration is not carefully described for this species. In the present specimens the cephalic and median tibiæ and cephalic femora are dark brown, becoming yellowish only at the immediate extremities, the cauda

tibiæ being similar, but becoming paler more extensively distad. The median and caudal femora are yellowish in about the proximal third and in a brief distal portion, the intervening area being strikingly contrasted in blackish brown.

Pygidicraninæ.

Burr's original generic arrangement of the Indian species of this group is clearly faulty[1]. His rearrangement of these species in his genitalic study[2], synonymizing *Pyge* and erecting a new genus *Acrania*, is apparently more satisfactory. As elsewhere in that paper, however, we feel that the external structure should have been much more thoroughly studied and that the characters of the metaparameres and virga should have been added to a general description of the external morphology in separating the genera, particularly in the case of the genus described as new.

Acrania picta (Guérin).

1838. *Pygidicrana picta* Guérin, Mag. de Zool., VIII, Pl. 236, fig. 1, p. 70. [♀; Madras.] Sidapur, Coorg, 31st October 1917 (T. R. Naganathan), one female.

In the present specimen the central oblique tegminal stripe extends unbroken to near the apex of the tegmen.

Length of body 18, length of pronotum 2·9, length of tegmen 5, exposed length of wing 1·7, length of forceps 5 mm.

Cranopygia raja (Burr).

1911. *Kalocrania raja* Burr, Jour. Asiatic Soc. Bengal (N. S.), VII, p. 773. [♂; Nilgiri Hills, 6,000 feet.]

Kodaikanal, Madras Presidency, 1920 (C. Leigh), one male, one large juv.

The original description of the Burmese type of *C. valida* (Dohrn)[3] shows that in the type there is quite as much reduction in the organs of flight as in the present specimen. From Burr's comments on *valida*[4] and the present insect, it would appear that very decided individual variation in the development of these parts occurs in both of these species.

The features of difference in coloration, ultimate male tergite and forceps, we believe, fully justify considering *raja* a distinct species.

[1] Fauna Br. India, Dermaptera, p. 53 (1910).
[2] *Jour. R. Microsc. Soc.*, 1915, p. 430 (1915).
[3] *Stettin. Ent. Zeit*, XXVIII, p. 344 (1867).
[4] Fauna Br. India, Dermaptera, p. 56 (1910).

Length of body 27·7, length of pronotum 4, width of pronotum 3·8, length of tegmen 6, length of forceps 7·2 mm.

Cranopygia pluto, new species. (Plate XX, figure 18.)

This large and sombre insect shows, in the male sex, a symmetrical type of forceps which differs widely from that of any other species of the Pygidicraninæ known to us.

Type: male ; Chin Hills, Burma, 1909 (Venning). [Hebard Collection, Type No. 775.]

Size large, form robust, the abdomen widening very strongly distad. Antennæ with first segment equal to combined length of second to fifth segments, second segment two-thirds as long as third, third with length one and one-half times its width, fourth slightly broader than long, fifth slightly longer than broad. Head with sutures sub-obsolete, frons and lateral portions of occiput flattened and showing very feeble convexity ; caudal margin of occiput straight, transverse ; eye slightly longer than cheek.

Pronotum distinctly narrower than head, slightly longer than broad, rectangular, with angles rounded and cephalic margin showing a very weak convexity ; prozona and metazona very feebly convex mesad, these portions separated by a broad but shallow, transversely arcuate sulcus. Tegmina short, truncate, without keels at shoulders, leaving a very large scutellum exposed. Wings not visible.

Abdomen pilose, widening distad to the very large ultimate tergite ; preceding tergite with latero-caudal angles bluntly rounded, in these areas irregularly rugose. Ultimate tergite broader than long, shining, rugulose and becoming rugose laterad and distad, raised in a low blunt projection above the internal portion of each arm of the forceps, moderately concave between these, with a very narrowly transverse, smooth area and laterad of these prominences more strongly concave. Pygidium concealed, directed cephalad.

Forceps heavy, symmetrical, almost evenly convex, but showing slightly the greatest curvature mesad ; dorsal surface impressed and longitudinally striate proximad, weakly convex distad, as is the entire ventral surface, which is well supplied with hairs. Forceps proximad very heavy, the internal portion of the arms produced so as to meet, forming a nearly vertical, interlocking series of a few heavy, blunt teeth, beyond this point the internal surface is concave as the arm narrows to the median point, the dorso-internal margin bluntly produced at its base, the ventro-internal margin armed with a series of minute but distinct tubercles to the median point. The distal half of the forceps is stout and expands very weakly at the apex, which is bidentate ;

the external (distal) portion blunt conical, the internal margin produced in a smaller blunt knob, with a few very small knobs along its distal face toward the distal projection. Penultimate sternite large, with lateral margins oblique to the broad apex, which is weakly concave mesad and convex laterad.

Limbs strongly compressed and carinulate. Caudal metatarsus slightly longer than combined length of the two succeeding joints ; hirsute, this very heavy ventrad.

Length of body 25·5, greatest width of head (across eyes) 3·74, length of pronotum 3·53, greatest width of pronotum 3·33, length of tegmen 4·7, greatest width of ultimate tergite 6·7, length of forceps 6·8 mm.

Head blackish chestnut brown, paling to cinnamon brown between the eyes. Antennæ tawny. Pronotum and tegmina dull, deep chestnut brown. Abdomen more polished, deep chestnut brown, darkening to blackish distad. Forceps blackish chestnut brown. Limbs immaculate, ochraceous tawny.

The type is unique.

Cranopygia kallipyga (Dohrn).

1863. [*Pygidicrana*] *kallipygos* Dohrn, Stettiner Ent. Zeit., XXIV. p. 53. [♂, ♀ ; Eastern India.]

Snowdon Peak, Nilgiri Hills, Madras Presidency, 8,000 feet, 6th September 1917 (Y. R. Rao ; on the bark of a tree), one male, one female.

In the male, the forceps have a stout tooth proximad at the external margin, directed dorsad. This is as originally described, not "somewhat crested irregularly," as given by Burr.

Length of body, male 20·5, female 19 ; length of pronotum male 3, female 3·3 ; width of pronotum male 2·8, female 3·1 ; total length of tegmen* male 3·6, female 3·6 ; length of forceps male 5, female 5·4 mm.

LABIDURIDÆ.

Psalinæ.

We agree with Burr's statements in 1915[1] that the genera *Psalis*, *Anisolabis* and *Euborellia*, as previously defined by him, constituted an unnatural grouping which necessitated complete rearrangement. We deplore his method in that paper, however, of erecting new genera based solely on the characters of the male metaparameres. We feel that, carefully studied,

* Concealed, except from the side, for 0·5 mm.

[1] *Jour. R. Microsc. Soc.*, 1915, *p.* 544.

such units, if valid, will show adequate diagnostic features of difference in the external structure. Until treated in such manner, however, it is a difficult matter to decide whether the genera so erected deserve recognition and still more difficult to place generically such species as Burr omitted from his evidently hurried genitalic study.

Homœolabis maindroni Borelli.

1911. *Homœolabis maindroni* Borelli, Boll. Mus. Zool. Anat. Comp. Univ. Torino ; XXVI, No. 640, p. 2. [♂, Pondicherry.] [Also recorded from Coimbatore, Bangalore and Coorg. T. B. F.]

Sidapur, Coorg, 13th to 14th May 1914 (T. Bainbrigge Fletcher), one female.

Coimbatore, Madras Presidency, 1921 (A. P. Nathan), one male, one female.

This species has been discussed by Burr[1]: we offer the following data :—

Stink glands obsolete. Abdominal surface very minutely impresso-punctulate dorso-proximad, more strongly so ventrad, almost smooth dorso-distad, well supplied with hairs distad and less decidedly so laterad ; distal tergites scarcely at all produced laterad. Pygidium vertical, very narrow. Forceps very similar in the sexes, very slightly heavier in male than in female ; heavy, with branches straight to the immediate apices, which are incurved ; ventral surface weakly and dorsal surface more strongly convex, the latter with a proximal scarification on external half, formed by a transverse series of short, irregular, longitudinal ridges and there well supplied with short hairs ; ventro-internal margin supplied with very low, blunt, nodiform teeth, which decrease in size and become more regular distad. Penultimate sternite with free margin broadly and evenly convex.

The armament of the caudal metatarsus in this species apparently agrees closely with that of *Titanolabis**. Ventral surface armed on external margin with a row of heavy, widely spaced spines, the entire ventral surface thickly supplied with elongate, stiff bristles, which on the ventral portion of the internal face become much more numerous and shorter, there appearing furry.

Length of body, male 17·3, female 16 and 19·5 ; length of pronotum† male 2·24, female 2·31 and 3·13 ; greatest (caudal) width of pronotum

[1] *Proc. Asiatic Soc. Bengal* (*N. S.*), VII, p. 777 (1911).

* Comparison is made with imperfect specimens of *T. colossea* (Dohrn), from New South Wales, Australia, in the Philadelphia Collections.

† Not including the greatly depressed neck which measures—Male, 0·24, female, 0·34 and 0·34 mm.

male 2·33, female 2·18* and 2·35; length of tegmen male 1·77, female 1·84 and 2·04; width of tegmen male 0·42, female 0·61 and 0·47; length of forceps male 3, female 3·26 and 3·4; proximal width of forceps male 1·36, female 1·37 and 1·38 mm.

Paralabis greeni (Burr). (Plate XIX, figure 3.)

1899. *Anisolabis greeni* Burr, Ann. Mag. Nat. Hist. (7), IV, p. 257. [♂, ♀; Pundalu-oya (nec Punduloya), Ceylon.]

Pundalu-oya, Ceylon, (E. E. Green), one male, "*type*" (which we here designate as single type), [British Museum].

Hopeville Estate, Shevaroy Hills, Madras Presidency, 16th October 1912 (T. B. Fletcher), one male, [British Museum].

Through the kindness of the authorities of the British Museum, we are able not only to diagnose Burr's *greeni* more fully, but also to verify the presence in Southern India of this species.

In *greeni* the head, pronotum, mesonotum, metanotum and dorsal surface of the abdomen are all very finely but decidedly and thickly impresso-punctulate, the tegmina slightly less so. This is not true for *P. castetsi* (Bormans) and *Epilabis penicillata* (Borelli). The former has the head and pronotum polished and punctulations sub-obsolete, the remaining dorsal portions with a finer punctulation; the latter has the head and pronotum polished and smooth and remaining portions even more finely punctulate.

Though in general structure agreeing more closely with *penicillata*, *greeni* does not show as decided narrowing of the abdomen caudad and the ultimate tergite is, therefore, wider. The male sex of that species is quickly distinguished by the remarkable specialization of the penultimate sternite.

The male forceps of *greeni* are weakly asymmetrical, with a sub-obsolete tooth meso-proximad, rather than mesad, as described by Burr. In the type the limbs, mouthparts and all but distal portion of the last of the first three antennal joints are tawny, the femora slightly darker distad. The Shevaroy specimen differs in having these portions less contrastingly paler than the other dark brown parts of the insect, the proximal antennal joints scarcely paler than the others. Both have the thirteenth antennal joint buffy or ochraceous.

The vestigial tegmina in this species and the apparently very closely related *P. astruci* (Burr) are of the same remarkable type developed in *castetsi* and *E. penicillata*.

* The pronotum is deformed in this specimen.

The generic position of the species is in doubt. The species certainly appears to be congeneric with *penicillata* and Burr stated the possibility of this being the case when referring *greeni* to his new genus *Paralabis*[1].

The measurements of the two males before us are as follows, those of the type being given first: length of body 14 and 14·2, length of pronotum (exclusive of neck) 2·14 and 2·35, width of pronotum 2·31 and 2·52, length of tegmen 0·88 and 1·04, width of tegmen 1·22 and 1·43, length of forceps 2·9 and 3·1 mm.

Paralabis castetsi (Bormans). (Plate XIX, figure 4.)

1897. *C[arcinophora] castetsi* Bormans in Bolivar, Ann. Soc. Ent., France, LXVI, p. 284. [♂, ♀; Kodaikanal, Madras Presidency, India.]

Kodaikanal, Madras Presidency, 26th March to 2nd April 1921 (C. Leigh), thirteen males, fourteen females, three juv.

This is a smaller, proportionately broader, darker and more polished insect than *P. greeni* (Burr). The development of the male forceps, moreover, is distinctive, the curvature different in the more specialized condition and the internal margin never toothed.

The species, like *greeni*, is subject to decided size variation. The maximum for the former is not as great, however, as the minimum known for the latter. Burr failed entirely to recognize its correct relationship, assigning it to the genus *Psalis* without comment.

The following changes are noted in depauperate individuals of the species. The arms of the male forceps from asymmetrical and wellbowed to similar and scarcely arcuate. The sides of the male abdomen with latero-caudal portions of the tergites from angulate, produced and carinulate to scarcely produced (and that only for the distal tergites), rounded and not carinulate.

In the present series the length measurements are: male 7 to 10·3, female 8 to 10·2 mm. The smallest males have the forceps so weakly curved that, in this respect, they are not distinguishable from some of the females.

In coloration the specimens have the head, pronotum and abdomen very dark, the antennæ and limbs paler. The antennæ have the first two joints, and sometimes one or two joints distad, paler than the others.

Epilabis penicillata (Borelli). (Plate XIX, figures 5 and 6.)

1911. *Euborellia penicillata* Borelli, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XXVI, No. 640, p. 3. [♂, ♀; Coonoor (India).]

[1] *Jour. R. Microsc. Soc.*, 1915, p. 540 (1915).

Ootacamund, Nilgiri Hills, Madras Presidency, May 1912 (K. S. Padmanabha), one male, one female.

The remarkable specialization of the male penultimate sternite, described by Borelli, is here figured. These specimens are paler and more reddish than the specimens of *Paralabis greeni* (Burr) before us, particularly cephalad. The antennæ and limbs are paler than the other portions much as in the specimen of *greeni* from the Shevaroy Hills, the former, however, showing no trace of annulation distad.*

Length of body, male 13·8, female 11·7, length of pronotum (exclusive of neck), male 2·04, female 1·94, width of pronotum, male 2·18, female 2·08, length of tegmen, male 0·85, female 0·85, width of tegmen, male 1·22, female 1·22, length of forceps, male 2·38, female 2·5 mm.

Euborellia annandalei (Burr).

1906. [*Anisolabis*] *annandalei* Burr, Jour. Asiatic Soc. Bengal (N. S.), II, p. 389. [♂; Comilla, Purneah District (Bengal).]

In Burr's latest revisionary work[1] this species is not assigned. The correct generic position consequently remains in doubt.

Comilla, Purneah District, Bengal, 20th February 1906 (C. S. Misra), two females.

This topotype is the first female of *annandalei* to be reported. The sex agrees closely with the description of the male, except in the following features: abdomen slightly widest mesad, distal tergites with latero-caudal angles bluntly produced at slightly over ninety degrees and with surfaces there impresso-punctulate. Ultimate tergite showing a very weak, medio-longitudinal, linear sulcus; surface weakly wrinkled distad; with a weak, blunt keel laterad, there impresso-punctulate. Penultimate sternite rectangulate produced caudad, with apex very broadly rounded. Forceps with branches straight to the incurved apices, weakly and bluntly triquetrous proximad, almost attingent, with ventro-internal margin showing a series of very small, blunt, nodiform teeth. The caudal metatarsus is armed with two ventral rows of small spines, flanked internally by a fringe of lamellate plates and well supplied with hairs. This same type is found in *Paralabis castetsi* (Bormans) and *Epilabis penicillata* (Borelli).

Length of body 13·2, length of pronotum 2·38, greatest (caudal) width of pronotum 2·28, length of tegmen 1·97, width of tegmen ·77, length of forceps 3·4 mm.

* See further comparison under that species.

[1] *Jour. R. Microsc. Soc.*, 1915-1916.

Euborellia stâli (Dohrn).

1864. *F[orcinella] stâli* Dohrn, Stettin Ent. Zeit., XXV, p. 286. [♀, Java.]

1907. *Anisolabis minuta* Caudell, Jour. New York Ent. Soc., XV, p. 168. [♂, ♀; Arroyo and Mayaguez, Porto Rico.]

Coimbatore, Madras Presidency, 1921 (A. P. Nathan), one male, one female.

Compared with a West Indian series, recorded by Rehn and Hebard as *Euborellia minuta* (Caudell), in 1917, demonstrates the synonymy indicated above. The size differences, which we noted at that time and which we believed indicated the probability of *minuta* being a distinct species, are worthless. Burr had already suggested the above synonymy,[1] but apparently without comparison of West Indian specimens with material from the Far East.

The West Indian material before us averages more recessive in coloration than the pair here recorded (which apparently show the normal coloration for Indian material), but, as would be expected, a number of specimens from the West Indies are fully as dark as these.

Length of body, male 8·2, female 9·7; length of pronotum, male 1·2, female 1·36; caudal width of pronotum, male 1·2, female 1·43; length of tegmen, male 0·95, female 1·09; width of tegmen, male 0·35, female 0·47 and 0·54; length of forceps, male 1·29, female 1·97 mm.

Euborellia annulipes (H. Lucas).

1847. *Forficesila annulipes* Lucas, Ann. Soc. Ent. France, (2), V, p. LXXXIV. ["Jardin des Plantes, Paris"; probably introduced.]

Abbottabad, Hazara District, North-West Frontier Province, 21st May 1915 (T. Bainbrigge Fletcher), one female.

Hangu, North-West Frontier Province, 10th May 1916 (T. Bainbrigge Fletcher), two males.

Sargodha, Chenab Colony, Punjab, August 1906 (H. M. Lefroy), one male.

Pusa, Bihar, 11th June to 21st September 1908 and 1920, two males, seven females, one juv. female.

Laitlyngkot, Khasia Hills, Assam, 5,500 feet, 16th October 1920 (T. Bainbrigge Fletcher), one male, one female.

Upper Shillong, Khasia Hills, Assam, 5,800 to 6,000 feet, 12th to 15th June 1918 (T. Bainbrigge Fletcher), one male.

Santikoppa, North Coorg, 4th to 10th May 1914 (T. Bainbrigge Fletcher; on fruit of *Careya arborea*), one female.

[1] Gen. Ins., Dermaptera, Fasc. 122, p. 31 (1911).

Coimbatore, Madras Presidency, 7th January 1921 (A. P. Nathan), one male, one female; 24th July 1912 (T. V. Ramakrishna Ayyar), one female.

The present series exhibits the usual colour variation shown by *annulipes*, the limbs being conspicuously annulate in the majority of specimens. In the examples from Laitlyngkot, however, the annuli are very broad, heavy and sharply defined, while in those from Hangu they are obsolete.

The latter specimens are exceptionally large and heavy for the species, the male showing the maximum curvature of the forceps developed, which closely resembles the normal type of these appendages developed in *E. mœsta* (Géné).*

The specimen from Santikoppa is very remarkable in possessing truncate tegmina, which overlap and reach slightly beyond the caudal margin of the mesonotum. A very few specimens of this species are known with fully developed tegmina and wings, but this is the first specimen to be recorded showing the present condition. The presence and character of the tegmina would lead one first to suppose this specimen to be near "*Psalis*" *lefroyi* (Burr) but we believe instead that it is simply an individual of *annulipes* abnormal in this respect.

Labidurinæ.

Labidura riparia (Pallas).

1773. *Forficula riparia* Pallas, Reise, Russ. Reichs, pt. II, p. 727. [Shores of Irtysch River, Western Siberia.]

The series of seventy-three Indian specimens, now before us, shows the same variability which was thoroughly discussed by Burr, in 1910.[1] At that time *bengalensis* was recognized as distinct species, but after careful consideration of the evidence at hand we feel convinced that it represents nothing more than the most striking variant developed in *riparia* in the Indian region. Burr reached the conclusion that *bengalensis* did not merit specific recognition in 1915.[2]

In spite of even greater variation than occurs in the species in the New World, the Indian examples show one average difference, varying in degree but exhibited by all the material before us from that region. This lies in the average slightly stronger denticulation of the ventro-internal margin of the

* Very close agreement in these features is shown by the optimum males before us from Miami, Florida.

[1] Fauna Br. India, Dermaptera, p. 100.

[2] *Jour. R. Microsc. Soc.*, 1915, p. 444.

forceps in the female sex. The largest specimens of the *bengalensis* variant show this feature strikingly. In the depauperate condition, which it would appear best to refer to as the *inermis* variant, however, this denticulation is likewise distinctly stronger than in any series before us from localities not in the Indian region.

In treating variants such as here occur, we believe that a system of symbols, much like that used by Rehn and Hebard for the American species of the genus *Gryllus*, constitutes the most satisfactory method by which the individuals recorded may be characterized. For the present species we would suggest the following :—

Coloration.

A—very light.
B—medium.
C—dark but showing contrasts.
D—dark and showing no contrasts.
E—brilliant.
F—moderately bright.
G—dull.

Organs of Flight.

W—very short, extreme tips of wings alone projecting.
X—short, tips of wings projecting.
Y—slightly reduced.
Z—fully developed.

Male Genitalia.

a—caudal margin of ultimate tergite unarmed.
b—caudal margin of ultimate tergite armed with two sub-obsolete points
c—caudal margin of ultimate tergite armed with two acute points.
d—internal margin of forceps with teeth sub-obsolete.
e—internal margin of forceps with a meso-distal tooth.
f—internal margin of forceps with a meso-proximal and a meso-distal tooth.
g—internal margin of forceps with a meso-proximal and a meso-distal tooth, and other smaller teeth.
h—internal margin of forceps with a meso-proximal and a meso-distal tooth, and other smaller teeth, the majority of which are beyond the meso-distal tooth.
w—serrulation of ventro-internal margin of female forceps obsolete.
x—serrulation of ventro-internal margin of female forceps very weak.
y—serrulation of ventro-internal margin of female forceps distinct.
z—serrulation of ventro-internal margin of female forceps well developed.

Size.

1—very large.
2—large.
3 medium.
4—small.
5—very small.

The variants included in the present series we would characterize as follows:—

riparia (Pallas) A to C, F to G, X to Z, a to c, d to f, w to y, 1 to 4.

Typical condition—BF $\left\{\begin{matrix}\text{Zc}\\\text{Xa}\end{matrix}\right\}$ ex $\left\{\begin{matrix}2\\3\end{matrix}\right\}$

bengalensis Dohrn[1] B to C, EZahz2.

icterica (Serville)[2] A to B, FXa, weak f to g, y, 3 to 4.

inermis (Brunner)[3] DGWa, d or very weak f to g, x to y, 5.

It is probable that Brunner's variety is based on merely the very depauperate condition of *riparia*, which is not as dark and does not have the tegmina as strongly truncate as does the Indian variant here characterized. If this is true, no name is available for the Indian condition, but we are opposed to naming any such variants and believe it best to record the present material as variant *inermis*, with this necessary qualification.

Gandarbal, Kashmir, 5,600 feet, September 1917 (Dutt), one male[4], BEZce2.

Keonthal, Simla Hills, 8,000 feet, December 1908 (G. M. Carson), eleven males, twelve females,[5] eight juv., DGWa, d to very weak g, y5.

Pusa, Bihar, 15th March to 1st November 1909 to 1914, six males, eight females, five juv., one pair CEYahz2, others[6] A to B, F, X to Z, a, weak f to g, weak z to z, 3 and 4.

Chapra, Bihar (Mackenzie), one male,[7] BEZah2, one female, BEZce2.

Comilla, Bengal Presidency, 19th January 1906 (A. Wahab), two juv.

[1] Described from Bengal as *Labidura bengalensis*, *Stettin Ent. Zeit.*, XXIV, p. 312 (1863).

[2] Described from Pondicherry as *Forficelisa icterica*, *Hist. Nat. Ins., Orth.*, p. 24 (1839).

[3] Described from Bruck, Lower Austria, and Serbia as *Labidura riparia* var. *inermis*, Prodr. Europ. Orth., p. 5 (18).

[4] Typical *riparia*, except in being more brilliantly coloured.

[5] This series is typical of the depauperate dark form, which is best called the *inermis* variant.

[6] Typical *icterica* variant.

[7] Typical *bengalensis* variant.

Goalundo to Gauhati, Brahmaputra River, Eastern Bengal, July 1919 (T. Bainbrigge Fletcher), five males, five females[1], CEZ, one b, others c. f, weak z, 2.

Dacca, Eastern Bengal, 23rd July 1917 (in parasitic growth on mango), one male, CEZbf2.

Nongpoh, Khasi Hills, Assam, July 1907 (D. Nowroji), one male, CZa, weak g, slender 2.[2]

Poona, Bombay Presidency, December 1908 (R. D. Deshmukh ; under stones), two juv.

Jubbulpur, Central Provinces, 9th January 1918 (A. G. Ramaswami), one female, BFXz3.

Coimbatore, Madras Presidency, 12th October 1912 (A. G. Ramaswami), one female, CGXz3.

The Keonthal series is of particular interest in showing the maximum degree of depauperation for the species. The extremes in this series are: length of body, male 8·7 to 13, female 9·7 to 12·1 ; length of forceps, male 3·2 to 4·3, female 3·7 to 4 mm. The smallest males might easily be mistaken for females, so greatly simplified are the forceps, while the ultimate abdominal tergite is narrowed and tapers distad.

The enormous size variation in the species is shown by the fact that the extremes of length, exclusive of forceps, for the series here recorded, are 8·7 to 22·5 mm.

Nala lividipes (Dufour). (Plate XIX, figures 7, 8 and 9.)

1820. *Forficula pallipes* Dufour, Ann. gén. Sc. phys. Bruxelles, V, p. 316, Pl. CXVI, figs. 7, 7*a* and 7*b*. [♂, ♀; Lower Catalonia, Spain.]

1828. *F* [*orficula*] *lividipes* (Dufour), new name proposed Ann. Sc. Nat., XIII, p. 340.

Haripur, Hazara District, North-West Frontier Province, 27th May 1915 (T. Bainbrigge Fletcher), one male.

Taru, Peshawar District, North-West Frontier Province, 16th to 29th May 1915 (T. Bainbrigge Fletcher), one male, one female.

Hoshangabad, Central Provinces, 14th to 19th September 1911 (T. Bainbrigge Fletcher), two females.

Janjgir, Bilaspur, Central Provinces, October 1915 (C. S. Misra), one male.

[1] One of these males has one of the arms of the forceps unspecialized, simple, cylindrical and 7 millimeters in length ; the length of the other normal arm being 9·7 millimeters.

[2] This condition agrees closely with the type of the synonymous *Apterygida huseinæ* Rehn, from North-Eastern Africa.

Pusa, Bihar, 31st March to 2nd November 1904 to 1919 (18 taken at light[1]), ten males, sixteen females.

Goalundo to Gauhati, Brahmaputra River, Eastern Bengal, July 1919 (T. Bainbrigge Fletcher), one male.

Barisal, Bengal, 29th May 1906 (H. M. Lefroy), one female.

Coimbatore, Madras Presidency (C. S. Misra), one female.

Lebong, near Darjiling, Sikkim, 5,000 feet, September 1908 (H. M. Lefroy), one female.

In a very few specimens the immediate basal portion and the tip of the exposed portion of the wings are slightly paler than elsewhere. In a larger number of specimens only the tips of these organs are slightly paler, but the great majority of individuals have tegmina and wings solidly unicolorous.

Accompanying size variation, we find the male forceps varying from an armed type (Plate XIX, figure 7), through an unarmed type (Plate XIX, figure 8), to a simple type (Plate XIX, figure 9), in which both teeth and characteristic curvature have disappeared. In the series before us the following males have armed forceps: Pusa 4, Goalundo to Gauhati 1, Taru 1, Janjgir 1. The specimen from Haripur has the form as normal for *lividipes*, but lacks the meso-distal teeth, while the other males are smaller and have evenly and weakly curved, unarmed forceps.

Nala nepalensis (Burr).

1907. [*Labidura*] *nepalensis* Burr, Rec. Indian Mus., I, p. 208. [♂, ♀; Soondrijal and Pharping, Nepal.]

Abbottabad, Hazara District, North-Western Frontier Province, June 1916 (T. Bainbrigge Fletcher), one male.

In this specimen the annulation of the limbs is reduced to a very weak suffusion, while the organs of flight show some reduction (length of tegmen 1·77, length of exposed portion of wing 0·27 mm.). Otherwise it agrees fully with the original description.

Forcipula decolyi Bormans.

1900. *Forcipula decolyi* Bormans, Ann. Mus. Civ. Stor. Nat. Genova (2), XX, p. 444. [♂, ♀; Haveri, British New Guinea.]

Palni Hills, Madras Presidency, 5,000 feet (C. Leigh), two females, two juv.

The adult females measure: length of body 22-26, length of tegmen 4·8-5, length of forceps 8-7·8 mm.

[1] See note by Annandale on appearance of this species at light, in Burr, Fauna Br. India, Dermaptera, p. 15 (1910).

Forcipula despinosa Hebard.

1917. *Forcipula despinosa* Hebard, Proc. Acad. Nat. Sc. Philadelphia, 1917, p. 234, Pl. XVI, fig. 1. [♂, Northern India.]

The microscopically pitted metazona, tegmina and wings are apparently the most distinctive features in this species.

We believe that the size and number of projections on the abdominal tergites are probably subject to considerable individual variation in the majority, if not all, of the species of *Forcipula*.

Forcipula lurida Bolivar.

1897. *F*[*orcipula*] *quadrispinosa* var. *lurida* Bolivar, Ann. Soc. Ent. France, LXVI, p. 283 [♂, Madras Presidency.]

Pusa, Bihar, 15th May 1917 (T. Bainbrigge Fletcher), one female.

Damukdia, Sara, Bengal, 26th March 1911 (T. Bainbrigge Fletcher; at light on steamer), one female.

Gauhati, Eastern Bengal, 25th April to 4th May 1918 (T. Bainbrigge Fletcher), two males.

The two males before us differ from the material previously recorded in having only the third and fourth tergites showing a lateral oblique keel, these keels produced in a tooth, the caudal margin of which bears very minute teeth. The reduction in number of such keels we believe to be wholly attributable to individual variation. In the male showing the greater reduction of these keels, the forceps lack all denticulation excepting the heavy median tooth.

Parisolabiinæ.

Pseudisolabis elegans Hebard.

1917. *Pseudisolabis elegans* Hebard, Proc. Acad. Nat. Sc. Philadelphia, 1917, p. 236, Pl. XVI, figs. 2 and 3. [♂, ♀; Kulu, Kangra, India.]

This species agrees with *P. tenera* Burr[1] in coloration, and with *P. immsi* Burr[2] in form of the male forceps. It is possible that all may eventually prove to be variants of one species. If two valid species alone survived, however, it is probable that these would be *P. burri* Borelli and *P. immsi* Burr.

[1] Described in Fauna Br. India, Dermaptera, p. 104, Pl. IV, fig. 36 (1910). [♂, Murree, Punjab.]

[2] Described in *Jour. Asiatic Soc. Bengal* (*N. S.*), IX, p. 184, fig., (1913). [♂, ♀; Kuridi, Jaunsar, Base of Himalayas, Northern India.]

Brachylabiinæ.

Metisolabis bifoveolata (Bolivar).

1897. [*Brachylabis*] *bifoveolata* Bolivar, Ann. Soc. Ent. France, LXVI, p. 285, Pl. 10, fig. 1. [♂, Madras Presidency.]

Kodaikanal, Madras Presidency, 26th March 1921 (C. Leigh), one female.

We can not agree with Burr's assignment, in 1911,[1] of this species to the genus *Ctenisolabis*. In the present specimen the antennæ have 14 segments, the third nearly twice as long as broad, the fourth rounded quadrate, the succeeding segments longer than broad, becoming more elongate and slender distad.

The first three antennal segments are dark reddish brown like the limbs, the other segments blackish like the dull head, pronotum, abdomen and forceps.

As figured by Bolivar, the eyes are only slightly longer than the cheeks. The antennæ are so jointed that they swing back readily, at a decided angle, to the apex of the first segment. This gives to individuals a distinctive facies which appears to constitute a peculiarity of the species of this subfamily.

The female before us differs from the described male in lacking stink glands, though there is a scarred emargination of the caudal margin of the third tergite on each side in place of these.

Length of body 11·8, length of pronotum 2·56, least (cephalic) width of pronotum 1·84, greatest (caudal) width of pronotum 2·79, greatest (meso-caudal) width of abdomen 4·08, length of forceps 2·18 mm.

Nannisolabis formicoides Burr.

1911. *Nannisolabis formicoides* Burr, Jour. Asiatic Soc. Bengal (N. S.), VII, p. 781. [♂, ♀; Shembaganur, Madura District, Southern India.]

Kodaikanal, Madras Presidency, 26th and 30th March 1921 (C. Leigh), two males, one female.

We cannot help feeling a certain amount of hesitancy in thus recording the present material. Though we have no direct evidence, there would seem to be a possibility that these specimens represent immature individuals of *Metisolabis bifoveolata* (Bolivar) and that *Nannisolabis* is a genus having no validity, including "species" based on the immature condition of that and other species of the *Brachylabiinæ*.

In the material before us, the eyes and antennæ are as in the female of *M. bifoveolata* here recorded, except that the tenth, eleventh and twelfth

[1] *Jour. Asiatic Soc. Bengal (N. S.)*, VII. p. 780.

antennal segments are buffy. The head, pronotum, abdomen and forceps are black and shining, the limbs buffy, but with femora suffused with blackish to near their extremities.

There is a scarred emargination on each side of the caudal margin of the third abdominal tergite in both sexes.

Length of body male 6·3 to 6·8, female 5·9 ; length of pronotum male 1·08 to 1·15, female 1·15 ; cephalic width of pronotum male 0·85 to 0·88, female 0·85 ; caudal width of pronotum, male 1·18 to 1·22, female 1·3 ; greatest (meso-caudal) width of abdomen, male 1·48 to 1·5, female 1·7 ; length of forceps. male 0·85 to 0·88, female 1·08 mm.

LABIIDÆ.

Labiinæ.

Spongovostox semiflavus (Bormans).

1895. *Sp*[*ongophora*] *semi-flava* Bormans, Ann. Mus. Civ. Stor. Nat. Genova, XXXIV, p. 385. [♂, ♀ ; Carin-Chebá and Carin Ghecù, Burma.]

Savira Butti, South Coorg, 22nd May 1914 (T. Bainbrigge Fletcher ; under bark), one female.

This unique female agrees so closely with the original description of *semi-flavus* that we feel justified in so recording it.

A large, blunt, internal projection on the arms of the forceps causes these to be attingent proximad, from which point they are slender, straight, with internal face showing minute denticulations, to the incurved apices.

Length of body[1] 6, length of pronotum 1·05, cephalic width of pronotum 0·95, caudal width of pronotum 1·22, length of tegmen 1·97, length of exposed portion of wing 0·54, length of forceps 1·9 mm.

Chætospania Karsch.

One problem concerning the use of this generic name confronts the systematist. That is the proper generic position of *major*, the genotype of *Platylabia*, described from a single female, from the Island of Celebes. Four species were originally described under *Platylabia*, the first of which has been selected as genotype.[2] The second, *thoracica*, is a species congeneric with *Chætospania*, while the third and fourth have been placed in synonymy under *Labia curvicauda* (Motschulsky).

[1] The specimen before us has shrunk considerably in drying.

[2] By Kirby, Syn, Cat, Orth, I, p. 21 (1904).

We hold that the true generic relationship of *major* cannot at the present time be determined, and that, as it is highly probable that *major* is not congeneric with *thoracica*, the generic name *Platylabia* must be held for the single species *major*. Should *major* and *thoracica* be found to be congeneric, *Chætospania* would fall as a synonym of the older *Platylabia*. On the other hand, should the Malayan and Burmese species *sparattoides* prove to be a synonym of *major* (as has been assumed, but not satisfactorily proven, by Burr), or congeneric with that species, the genus *Palex*, which Burr erected for *sparattoides* and then placed under *Platylabia*, would indeed fall as a synonym of *Platylabia*. This latter conclusion we cannot concur in, on the same grounds that we retain *Chætospania*.

Hence we recognize, for the present, the genera : *Platylabia*, with genotype *major*, from the Island of Celebes ; *Chætospania*, with genotype *inornata*, from Madagascar ; and *Palex*, with genotype *sparattoides*, described from the Islands of Penang and Sumatra.

The most important references bearing on this complicated problem may be summarized as follows :—

1867. *Platylabia* Dohrn, Stettin Ent. Zeit., XXVIII, p. 347.

1886. *Chætospania* Karsch, Berliner Ent. Zeitschr., XXX, p. 87.

1895. *Platylabia major* Bormans, Ann. Mus. Civ. Stor. Nat. Genova, XXXIV, p. 380.

1900. *Platylabia sparattoides* Bormans, Ann. Mus. Civ. Stor. Nat. Genova, XL, p. 459.

1910. *Palex* Burr, Fauna Br. India, Dermaptera, p. 68 and Trans. Ent. Soc. London, 1910, p. 162.

1911. Burr, Stettin Ent. Zeit., 1911, p. 338 ; Jour. Asiatic Soc. Bengal (N. S.), VII, p. 774 and 775, and Deutsch. Ent. Nat.-Biblioth, II, 1911, p. 60.

1912. Burr, Annal. k. k. Nat.-hist. Hofmus. Wien, XXVI, p. 82.

Chætospania kurseongæ, new species. (Plate XIX, figures 10 and 11.)

This handsome little insect is distinguished from the other known species of the genus by the striking contrast of coloration and form of the pygidium in the sexes.

Type : male ; Kurseong, Northern Bengal, India. Altitude 4,500 feet. June 1920. (From C. Leigh.) [Hebard Collection, Type No. 770.]

Size small, form moderately slender and depressed. Head flattened, sutures sub-obsolete, caudal margin of vertex broadly and roundly obtuse-angulate emarginate. Eye slightly over half as long as cheek. Antennæ with first joint twice as long as third, fourth as long as third, succeeding joints

nc reasing gradually in length distad, grading from very elongate pyriform to elongate ovate. Pronotum distinctly narrower than head ; prozona very feebly convex, remaining portions deplanate ; lateral margins straight and parallel, caudal margin broadly convex. Tegmina and wings fully developed. Abdomen lacking stink glands, widest meso-distad, ultimate tergite thickened above forceps and impressed in intervening area.

Pygidium convex declivent and as broad as arm of forceps to distal portion, which is horizontally produced in a flange, with short lateral margins diverging slightly, so that this flange completely fills the space between the forceps, its caudal margin transverse. Forceps nearly straight to incurved apices, flattened dorsad and ventrad and showing a faint longitudinal linear sulcation along the external margins ; internal surface concave proximad, with ventro-internal margin there sub-serrulate, armed with a heavy tooth, directed mesad at end of proximal three-fifths, this tooth formed by a gradual widening of the ventro-internal margin from half the distance to the base of the forceps. Penultimate sternite broadly convex, almost truncate distad.

Limbs short, femora stout. Caudal metatarsus as long as last tarsal joint, armed ventrad with two rows of spines and well supplied with hairs on ventral portion of internal surface. Second tarsal joint short and simple. Entire insect pilose.

Allotype : female ; same data as type. [Hebard Collection.]

Agrees with male except as follows : ultimate tergite with thickening at bases of forceps slightly heavier and intervening area less depressed. Pygidium more weakly declivent, proximal portion weakly convex, directed disto-ventrad, so that the pygidium projects further, distal portion horizontal ; lateral margins straight, parallel and weakly serrulate, distal margin very weakly obtuse-angulate emarginate, thus large and weakly acute-angulate, deplanate disto-lateral angles are formed.

Forceps slightly heavier than those of male ; ventro-internal margin weakly serrate proximad, expanding gradually into a flange beyond pygidium to median point, thence as this flange gradually narrows its margin undulates, disappearing at base of incurved distal extremity of forceps. Penultimate sternite with free margin broadly convex, but more strongly convex than in male.

Length of body, male 7·5, female 7·7 ; length of pronotum, male 1·08, female 1·05 ; width of pronotum, male 0·92, female 0·95 ; length of tegmen, male 1·84, female 1·97 ; length of exposed portion of wing, male 0·98, female 1·02 ; greatest width across tegmina, male 1·5, female 1·54 ; length of forceps, male 2·58, female 2·45 mm.

Coloration of sexes. Head, tegmina and wings blackish brown, covered with coppery pile. Antennæ prout's brown, the last three (tenth to twelfth) segments warm buff. Pronotum, prosternum and limbs ochraceous-buff tinged with tawny, remaining underparts tawny, except the mesosternum which is suffused with blackish. Abdomen russet, becoming slightly deeper distad and there matching the pygidium and forceps.

The typical pair alone represent the species.

Chætospania stiletta Burr. (Plate XIX, figures 12 and 13.)

1911. *Chætospania stiletta* Burr, Jour. Asiatic Soc. Bengal (N. S.), VII, p. 786. [♂, ♀; Shembaganur, Madura District.]

Kodaikanal, Madras Presidency, 1920 (C. Leigh), three males, two females, three juv.

The cephalic femora, which are strikingly darker than any other portion of the limbs, lanceolate male pygidium, more highly specialized forceps and comparatively large size are features which readily distinguish this species from any of the other known forms of the genus.

The species bears a striking, though purely superficial, resemblance to certain species of the American genus *Prosparatta*, agreeing closely in size and form with the Mexican *P. flavipennula* (Rehn), though appreciably more deplanate.

As the pygidium and forceps have not been previously figured, we have given illustrations of these appendages for both sexes of this interesting species.

Length of body, male 9·7, female 9·1; length of pronotum, male 1·38, female 1·3; width of pronotum, male 1·15, female 1·06; length of tegmen, male 2·24, female 2·25; length of exposed portion of wing, male 1·15, female 1·22; greatest width across tegmina, male 1·8, female 1·84; length of forceps, male 3·33, female 3·2 mm.

Labia pilicornis (Motschulsky).

1863. *Forfiscelia pilicornis* Motschulsky, Bull. Soc. Imp. Nat. Moscou, XXXVI, Part 2, p. 2. [♀; Nuwara Eliya Mountains, Ceylon.]

Pusa, Bihar, 17th November 1916 (H. Singh), one female.

This specimen, like material which we have recorded from the Hawaiian Islands, is blackish mummy brown, paling gradually to tawny on the forceps. As a result it is an appreciably darker insect than *L. minor* (Linnæus), though, as Burr has stated, there is some superficial resemblance between these species. Both are so small that the striking structural differences which they exhibit can scarcely be noted by the naked eye.

Prolabia arachidis (Yersin).

1860. *Forficula arachidis* Yersin, Ann. Soc. Ent. France (3), VIII, p. 509, Pl. X, figs. 33 to 35. [Adventive at Marseilles, France.]

Pusa, Bihar, 20th October 1908 (R. D. Deshmukh ; at light), one female ; 7th November 1906 (H. M. Lefroy), one male.

This greasy and unprepossessing species has become widely established through the tropical regions of the earth.

FORFICULIDÆ.

Chelisochinæ.

Exypnus koorgensis, new species. (Plate XX, figures 14 and 15.)

It is a difficult matter to assign this interesting, though plainly coloured, species to the proper genus. The more slender tarsal joints, with second joint failing to reach the median portion of the third joint, alone prevent its being referred to *Chelisoches*. The tibiæ, which are flattened dorsad in nearly their entire distal half, prevent assignment to *Adiathetus*.

The species, when compared with *E. pulchripennis* (Bormans), may be found to represent a distinct genus. Material of that species is not at present available.

Type : male ; Sidapur, Coorg, India. Elevation 3,000 feet. 19th June 1917 (T. R. Naganathan). [Hebard Collection, Type No. 773.]

Size and form medium, close to that of *Chelisoches morio* (Fabricius). Head with frons weakly and lateral portions of occiput decidedly more tumid, separated by the broad deep sutures ; caudal margin of occiput moderately concave. Eye three-fifths as long as cheek. Antennæ with eighteen segments ; first segment equal to combined length of second, third and fourth ; second segment slightly over twice as long as broad ; third two-thirds as long as second ; succeeding segments increasing slightly in length and slenderness distad, these segments elongate ovoid, not showing the conical tendency found in *C. morio*.

Pronotum slightly longer than wide, lateral margins parallel but curving very weakly to the cephalic angles, caudal margin convex ; prozona moderately tumid, with a weak medio-longitudinal impressed line and an impressed point on each side. Tegmina and wings fully developed, smooth, without keels ; the former with distal margin weakly concave.

Abdomen supplied with stink glands, those of the second tergite small, of the third tergite prominent ; surface impresso-punctulate laterad, this very weak on ultimate tergite. Ultimate tergite as in *C. morio ;* roughly bossed above bases of forceps, with a depression between, in which are four small raised points, the median pair being slightly cephalad of the others.

Pygidium vertical, with caudal surface convex. Forceps well separated, cylindrical, elongate, scarcely convex convergent to the incurved apices, which meet; proximad the internal surface of each arm is produced in a heavy, weakly bilobate projection, these projections touch, beyond, the ventro-internal margin is armed with a few sharp, well spaced serrations, the heaviest of which is at base of distal fourth. Penultimate sternite with distal margin evenly and weakly convex, except mesad, where it is weakly and roundly obtuse-angulate emarginate.

Tarsal joints slender, first joint as long as third, second extending beneath third distinctly less than half distance to apex. Ventral surface of caudal metatarsus strongly hirsute, with a few widely placed spines along external margin, which are difficult to detect.

A paratypic male, bearing the same data, except that it was taken two days earlier, shows the brachylabic condition of the species. This condition is so distinct that the following differences should be noted :—

Pronotum distinctly less elongate. Forceps very much shorter, evenly but very weakly convex to the attingent apices; the internal basal projections less proximal, so a brief space intervenes between their proximal margins and the pygidium, more slender, forming a long blunt tooth on each side; beyond the ventro-internal margin is unarmed except for a minute bi-denticulation near end of proximal two-fifths.

Length of body[1] 13 and 12, length of pronotum 2·08 and 1·8, greatest width of pronotum 1·94 and 1·78, length of tegmen 4·1 and 3·7, length of exposed portion of wing 1·75 and 1·5, length of forceps 5·6 and 2·9 mm.

Head, pronotum, tegmina and abdomen blackish chestnut brown, the latter slightly the darkest. Antennæ dark chestnut brown, with thirteenth segment buffy. Exposed portion of wings ochraceous-tawny, broadly suffused with blackish chestnut brown along the external margin. Forceps russet, deepening to chestnut brown distad and with teeth of that colour. Limbs tawny, the femora suffused with chestnut brown in proximal portions.

The species is known from the two males discussed above.

Proreus simulans, (Stâl).

1860. *Forficula simulans*, Stâl, Kongl. Svenska Freg. Eugenie's Resa, I, p. 302. [♂, Java.]

Pusa, Bihar, 30th September to 18th December 1908 and 1915 (two in sugarcane), three males, one female.

[1] The measurements of the macrolabic male type are given first, of the brachylabic male paratype last.

Chaumuhani, Noakhali, Bengal, 29th November 1911 (C. C. Ghosh; light trap in rice field), one male.

In the material here recorded, the pronotal form shows unusual variation in length and in the lateral margins, which in one individual are parallel, but in the others diverge weakly caudad. Such variation is also shown in a Philippine series at hand, the majority from that island having the elongate type, with sides parallel or nearly so.

The males here recorded all have the forceps armed on the ventro-internal margin with a small tooth, situated slightly beyond the median point and another heavier tooth, just before the apex, this margin finely serrulate to the first of these teeth. In the Philippine series the analogous teeth differ not only in position but also in size. The first is larger than the largest in the Indian material and is situated at the end of the median third, while the second is very small and situated just before the apex. This latter tooth is sometimes absent. The ventro-internal margin is instead finely serrulate between these teeth.

The material before us shows clearly that we have an exceptionally variable insect to consider, and we therefore do not feel justified, without a large series from many localities, in recognizing the Indian insect as distinct from the Javan *simulans*, with which our Philippine material fully agrees.

Further embarrassment is caused by the fact that *Forficula modesta* Stâl, described from Hong Kong, has been placed as a synonym of *simulans* by Burr, though having line priority. As *modesta* is described as lacking wings, while all of the material before us has fully developed organs of flight, and may in addition very possibly show other more important differences, we do not believe it advisable, at present and without Chinese material for comparison, to assign *simulans* to synonymy under *modesta*.

Proreus melanocephalus (Dohrn).

1865. *L[obophora] melanocephala* Dohrn, Stettin Ent. Zeit., XXVI, p. 75. [♂, ♀; Tranquebar, India.]

Pusa, Bihar, 7th January to 18th December 1908 to 1918 (on sugarcane, in sugarcane stems bored by borers and inside rice stubble), twelve males, thirteen females, four juv.

Tamkohi, Gorakhpur, United Provinces, 20th April 1910 (H. M. Lefroy), one male.

The dimorphism found in the male sex of this diminutive species is more extensive and striking than in any other form of the Dermaptera known to us. Two conditions are developed, showing great difference not only in the ultimate

dorsal tergite and the pygidium, but in the shape and armament of the forceps as well. As these have not been fully described, we give the following data:—

Type *a*. Five males. Pusa. Ultimate dorsal tergite decidedly thickened caudad, the crest of the blunt ridge thus formed strongly rugose, its caudal face sloping strongly ventrad, with area above pygidium smooth and distinctly, though not strongly, concave. Pygidium vertical, fitting tightly between forceps and apparently roughly quadrate, its exposed caudal surface very weakly convex. Forceps short and heavy, curving to the apices, with a comparatively large, blunt ventro-internal tooth, at end of proximal third.

The forceps vary in heaviness, the arms are weakly bent inward in some of these specimens while the tooth varies in relative size and in some is almost mesal in position.

Type *b*. Eight males. Pusa and Tamkohi. Ultimate dorsal tergite showing only slight convexity above internal portion of bases of forceps, between these narrowly impressed, with caudal margin heavily cingulate. Pygidium very narrowly produced caudad, forming a very narrowly transverse shelf, with (apparent) caudal margin thickened and very weakly concave mesad, from that point with surface suddenly deplanate and so sharply declivent that it lies in a plane sloping ventro-cephalad. The pygidium thus fills the interval between the arms of the forceps, with its apex tucked far beneath the penultimate sternite. Forceps moderately elongate and showing slightly the greatest curvature proximad, armed with a stout dorso-internal tooth just beyond the pygidium and with ventro-internal margin developed in a weak flange to opposite that point, the ventro-internal margin irregularly serrulate to end of proximal two-thirds, the last of these small teeth often distinctly the heavier.

The antennæ have fifteen or sixteen segments in this species.

In specimens showing the greatest contrast of coloration, the first two antennal segments are blackish, the following two segments yellowish brown, the others decidedly darker, though usually paling slightly distad.

Proreus fletcheri,[1] new species. (Plate XX, figures 16 and 17.)

This species is related to *P. melanocephalus* (Dohrn), showing closer affinity to *P. delicatulus* Burr and *P. cunctator* Burr[2] in having two minute but distinct tubercles on the caudal margin of the ultimate tergite.

[1] Named in honour of T. Bainbrigge Fletcher who secured the specimen upon which this species is based and through whose kind co-operation the preparation of the present paper has been made possible.

[2] These species were described in 1911, *Jour. Asiatic Soc. Bengal* (*N. S.*), VII, pp. 789 and 790.

It is very possible that these species should be recognized as generically distinct from *simulans* (Stâl), genotype of *Proreus*. Of these, *fletcheri* is the largest, shows the greatest uniformity of coloration and is apparently further differentiated by the very elongate antennal segments and the flattened head.

Type: male; Goalundo to Gauhati, Brahmaputra River, Eastern Bengal, India. July 1919 (T. Bainbrigge Fletcher). [Hebard Collection, Type No. 774.]

Size small, larger than is usual for *melanocephalus*; form rather stout and moderately depressed, slightly stouter and more depressed than in that species. Head decidedly flattened, eyes three-fifths as long as cheeks, sutures broadly impressed; caudal margin of head nearly transverse, not showing the weak but distinct concavity which is found in *melanocephalus*. Antennæ with (sixteen and nineteen) segments, which are much more elongate than in that species; first segment large and nearly as long as combined length of second to fifth segments, second segment minute, third twice as long as broad, fourth two-thirds as long as third, fifth as long as third; distal segments very elongate and slender, fully five times as long as greatest width. Pronotum very slightly longer than wide, with lateral margins sub-parallel and caudal margin very broadly convex; surface with cephalic and lateral portions of prozona very feebly tumid, remaining portions deplanate. Tegmina and wings fully developed.

Abdomen with stink glands distinct, surface more coarsely impresso-punctulate than in *melanocephalus* and supplied with more numerous, heavier hairs. Ultimate tergite weakly tumid above internal portion of forceps, the interval between these weakly impressed, the caudal margin there bearing two minute tubercles which diverge, as they are directed latero-caudad.

Pygidium nearly vertical, directed weakly ventro-cephalad and completely filling space between forceps; its surface flattened, smooth mesad, rugulose laterad, with a very minute tubercle ventrad on each side. Forceps stout, flattened cylindrical, curving from their heavy bases to their sub-attingent apices, this curvature slightly greatest proximad, where, just beyond the pygidium, there is a small, stout tooth situated mesad on the internal surface, connected with the ventral margin proximad by a minute, short ridge. Caudal margin of penultimate sternite weakly concave mesad and weakly convex laterad.

Tibiæ flattened dorsad, cephalic and median tibiæ in distal half, caudal tibiæ in distal third. Caudal metatarsus slightly longer than combined length of second and third joints.

Length of body 9·3, length of first antennal segment 0·75, length of longest distal antennal segment 0·61, length of pronotum 1·53, width of pronotum 1·4, length of tegmen 2·31, length of exposed portion of wing 1·43, greatest width of abdomen 2·24, length of forceps 2·04 mm.

Head and proximal portions of antennæ deep prout's brown, the latter paling to prout's brown distad. Pronotum, tegmina and wings deep prout's brown. Abdomen and forceps blackish chestnut brown. Limbs and underparts prout's brown, excepting the blackish chestnut brown abdomen and forceps.

The type is unique.

Adiathetus tenebrator (Kirby).

1891. *Chelisoches tenebrator* Kirby, Jour. Linn. Soc., Zool., XXIII, p. 521, Pl. XII, fig. 5. [♀, India.]

Pollibetta, Coorg, 24th October to 16th November 1915 (T. Bainbrigge Fletcher; under bark), ten males, four females.

Sidapur, Coorg, 3rd and 12th May 1917 (T. R. Naganathan), two males.

Mercara, Coorg, 15th to 20th October 1915 (T. Bainbrigge Fletcher), one juv.

Coondapur, South Kanara District, 23rd September 1913 (T. V. Ramakrishna Ayyar), one juv.

The male sex of this large black species remained unknown, until described by Burr, in 1911.[1]

As in *Chelisoches morio* (Fabricius), the males develop forceps either dilated in a strong flange in proximal two-fifths, or tapering gradually without flange. Gradations between these types are shown by the series before us, four specimens being of the simple type. The difference in superficial appearance between the extremes is very striking.

The present series shows the following extremes in measurement: length of body, male 13 to 21, female 15 to 20; length of forceps, male 7·3 to 9·4, female 10 to 11·7 mm.

In the adults the antennæ are black, with eleventh and twelfth, or twelfth and thirteenth segments either dark brown or buffy brown. In the immature condition these annuli are much more conspicuous, pale buff.

ANECHURINÆ.

Allodahlia macropyga (Westwood).

1839. *Forficula macropyga* Westwood, in Royle, Illustr. Bot. Nat. Hist. Himalaya Mts., Vol. I, p. LIII, Vol. II, Pl. IX, fig. 12. [♂, ♀; (by inference) Himalayas or India.]

[1] *Jour. Asiatic Soc. Bengal (N. S.)*, VII, p. 791.

Kulu Valley, Kangra, Punjab (M. M. Carleton), one male, four females [Museum of Comparative Zoology, Cambridge].

Amballa, Punjab (M. M. Carleton), one male, one female [Hebard Collection].

Ramgarh, Kumaon Hills, North-Western Provinces, 6,000 feet, 21st to 26th August 1918 (T. Bainbrigge Fletcher), six males, five females.

Masuri, United Provinces, 7,000 feet, October 1906 (H. M. Lefroy), one juv.

Four males have the specialization of the forceps less decided than is normal for the species, this being very pronounced in one of these specimens.

Anechura stoliczkai Burr. (Plate XX, figures 19 and 20.)

1911. *Anechura stoliczkai* Burr, Jour. Asiatic Soc. Bengal (N. S.), VII, p. 792. [♂, ♀; Bashahr, Upper Sutlej District, Northern India.]

Kulu, Kangra, Punjab (M. M. Carleton), one male, four females [Museum of Comparative Zoology, Cambridge and Hebard Collection].

Jallore Pass, Kulu, Kangra, Punjab (M. M. Carleton), one male [Museum of Comparative Zoology, Cambridge].

Burr has described the macrolabic condition. The brachylabic male before us not only has very different forceps, but the ultimate tergite has its surface much less specialized distad, while the pygidium is modified and concealed by the much heavier proximo-internal projections of the forceps.

Length of body[1], male 13·5 to 13·5, female 12 to 13; length of pronotum, male 1·84 to 1·63, female 1·53 to 1·7; greatest width of pronotum, male 2·38 to 2·31, female 2·04 to 2·32; length of tegmen, male 3·46 to 3·5, female 3·4 to 3·74; length of exposed portion of wing, male 1·97 to 1·77, female 1·77 to 1·86; length of forceps, male 3·4 to 7·6; female 3·6 to 4·9 mm.

The general coloration is blackish chestnut brown, the abdomen meso-proximad and distad and the forceps being rich chestnut.

The general facies of this insect is very different from that of the other known Indian species of the genus.

Forficulinæ.

Elaunon bipartitus (Kirby).

1891. *Sphingolabis bipartitus* Kirby, Jour. Linn. Soc. Zool., XXIII, p. 526. [♂, ♀; India.]

[1] The present material is dried after immersion in alcohol and the body length can, in consequence, only be estimated. In these measurements those for the brachylabic male are given first.

Coimbatore, Madras Presidency, 11th February 1914 (C. S. Misra), one male.

In this specimen the fourth antennal segment is about twice as long as wide and slightly shorter than the third. Burr has discussed this segment in his original description of the genus,[1] but has described it later as "transverse," through a *lapsus calami*.[2]

Length of body 8·8, length of pronotum 1·2, greatest width of pronotum 1·36, length of tegmen 3·35, length of exposed portion of wing 1·5, greatest width of abdomen 2·18, length of forceps 3·2 mm.

Forficula schlagintweiti (Burr). (Plate XX, figures 21 and 22.)

1904. *Anechura schlagintweiti* Burr, Trans. Ent. Soc. London, 1904, p. 313. [♂, ♀: Lahol, Tibet; Darjiling, Northern India.]

1911. *Forficula beebei* Burr, Jour. Asiatic Soc. Bengal (N. S.), VII, p. 795. [♂, ♀; Phallut, Darjiling District (India), at 12,000 feet.]

Eastern Nepal, April, 1910 (C. W. Beebe; from seed pods of a red and yellow lily), two males, two females [Hebard Collection].

Kulu Valley, Kangra, Punjab (M. M. Carleton), two males.

Burr, in his discussion of *beebei*, states that the species is distinguishable from *schlagintweiti* by its lustre and the form of the male pygidium. The former feature is not to be relied on by itself and the pygidial difference we believe to be simply the adaptation of that segment to an Anechuroid type of forceps.

After considering the other Indian species at hand, which show dimorphism in the male sex, and the material here recorded, we are convinced that *beebei* is a synonym of *schlagintweiti*, based on the phase of that species in which the male pygidium shows full and unrestricted development and the forceps an Anechuroid type.

The description of *schlagintweiti* shows the males there considered to be, on the other hand, of the form in which the male pygidium is modified sufficiently to permit the development of a Forficuloid type of forceps.

The gradation between these types of forceps in *schlagintweiti* had been previously noted by Burr.[3]

Of the present material, three males have the pygidium bidenticulate and the forceps Anechuroid, one of these and the two females lack wings. The other specimen, a male from Nepal, has the pygidium bluntly convex, the

[1] *Trans. Ent. Soc. London*, 1907, p. 123 (1907).
[2] Fauna Br. India; Dermaptera, p. 163 (1910).
[3] Fauna Br. India, Dermaptera, p. 166 (1910).

forceps Forficuloid and possesses fully developed tegmina and wings. In this specimen the proximo-internal tooth of the forceps is very large, with broad, flat apex serrulate.

Measurements (in millimeters).

	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Exposed length of wing	Length of forceps
Male—						
NEPAL. Forficuloid	8·0	1·38	1·70	2·79	1·22	2·74
NEPAL. Anechuroid	7·0	1·04	1·45	2·06	..	2·58
KULU. Anechuroid	8·7	1·22	1·45	2·18	1·16	2·79
KULU. Anechuroid	9·8	1·36	1·61	2·31	1·32	3·20
Female—						
NEPAL.	7·8	1·29	1·58	2·18	..	2·18
NEPAL.	8·0	1·32	1·70	2·18	..	2·18

The differences developed in the male forceps are shown by the accompanying figures. Burr has discussed these in his descriptions, the references to which are given above.

In this species the caudal tibiæ are heavy to the median point, whence they taper strongly to their apices. This is due to a conspicuous flattening of the dorsal surface in the area opposable to the caudal metatarsus. This is indicated, but to a lesser degree, on the median tibiæ. We note a short dorso-distal flattening of the caudal tibiæ in other species of the genus, but by no means the striking character shown by *schlagintweiti.*

Forficula lebongae, new species. (Plate XX, figure 23.)

This species is related to *F. schlagintweiti* Burr, but may be quickly distinguished by the nearly semicircular and weakly transverse pronotum ; generally somewhat less stocky build ; somewhat more slender antennal joints and limbs, and slender, unspecialized tibiæ. Though of the same general type as developed in the Forficuloid condition of that species, the male forceps in *lebongæ* are more evenly curved and show less flattening.

Type: male ; Phoobsering, Lebong, Sikkim. Elevation 5,000 feet. October 1910 (H. M. Lefroy). [Hebard Collection, Type No. 781.]

Size medium, form moderately robust. Head weakly convex, sutures obsolete ; caudal margin of occiput transverse, showing very faint concavity

mesad. Eye oblique, three-quarters as long as cheek. Pronotum weakly transverse, nearly semicircular, curvature of lateral and caudal margins strongest latero-caudad; median section very feebly tumid in V-shaped area, lateral portions very feebly concave, cephalic angles rounded rectangulate. Tegmina and wings fully developed, smooth and shining, costal margin of the former sharply rounded, caudal margin transverse, truncate. Abdomen with glandular folds of third tergite very weak, of fourth tergite well developed; surface strongly impresso-punctulate, this weak on proximal tergites. Ultimate tergite four times as wide as long, lateral margins weakly convergent caudad, surface weakly tumid distad above bases of forceps, weakly concave between and on each side.

Pygidium small and inconspicuous, directed ventro-caudad; exposed face semicircular, smooth, but with a linear sulcus paralleling and just within the free margin; apex ventrad, concealed. Forceps at immediate base with internal portion thickened into a very short flange, better described as a heavy, blunt tooth, the broad flattened apex of which bears a few minute, irregular, blunt denticulations; arms there touching, from that area convex to the apices, so that in major portion they are rather strongly and evenly bowed. Penultimate tergite with free margins straight, convergent to the bluntly rounded apex. Limbs slender and moderately elongate, caudal metatarsus equal in length to the two succeeding segments.

Length of body 9·2, length of pronotum 1·24, greatest width of pronotum 1·59, length of tegmen 2·31, dorsal width of tegmen 1·26, length of exposed portion of wing 1·43, greatest width of abdomen 2·52, length of forceps 2·74, length of margin of proximo-internal flange (or tooth) of forceps 0·36, length of caudal femur 2·24, length of caudal tibia 1·9 mm.

Head and pronotum blackish brown, the sides of the latter paler. Tegmina, wings and sides of pronotum prout's brown, translucent and cinnamon brown when held to the light. Abdomen bay, the ultimate tergite, glandular folds and narrow proximal portions of other tergites darkened. Forceps in enlarged proximal portions bay, remaining portions blackish brown. Limbs bay, paling to buckthorn brown in distal portions.

The type is unique.

Forficula beelzebub (Burr).

1900. [*Chelisoches*] *beelzebub* Burr, Ann. Soc. Ent. Belgique, XLIV, p. 51. [♂; Kurseong, Bengal, India.]

Kurseong, Bengal, (from C. Leigh), twenty-one males, ten females, one juv.

Among the males, one has the forceps deformed and lacking a proximo-internal flange; another has the dextral arm only slightly over half as long as the sinistral arm and unspecialized; while a third has the dextral arm very similar to the characteristic condition developed in the female sex.

The present series does not show much individual variation, the extremes being as follows: length of body, male 9·5 to 11, female 12·2 to 13; length of pronotum, male 3 to 3·2, female 1·77 to 1·9; greatest width of pronotum, male 2·13 to 2·3, female 2·48 to 2·5; length of tegmen, male 3 to 3·2, female 3·33 to 3·53; length of exposed portion of wing, male 1·18 to 1·6, female 1·5 to 1·56; length of forceps, male 3·9 to 4, female 3 to 3·2; length of proximo-internal flange of male forceps 1·09 to 1·18 mm.

Forficula acris (Burr).

1905. *Forficula acer*[1] Burr, Jour. Asiatic Soc. Bengal (N. S.), I, p. 30. [♂; Mung Phu, Sikkim.]

1905. *Forficula celer* Burr, Jour. Asiatic Soc. Bengal (N. S.), I, p. 31. [♂, ♀; Khasi Hills (Assam), India.]

Kulu, Kangra, Punjab (M. M. Carleton), one female [Museum of Comparative Zoology, Cambridge].

Shillong, Khasi Hills, Assam, 5,000 feet, April to October 1916 to 1920 (Fletcher and Rao; four on apple blossoms and shoots, four on rose flowers), twenty males, seventeen females.

Ramgarh, Kumaon Hills, North-West Provinces, 6,000 feet, 21st to 26th August 1918 (T. Bainbrigge Fletcher), one female.

The present large series from Shillong furnishes convincing evidence of the synonymy indicated above. Burr has described a macrolabic male as *acer*[2] and a brachylabic male of the same species as *celer*.[3]

A single specimen from Shillong is strongly macrolabic. In this specimen the pronotum is appreciably more transverse, the pygidium decidedly more elongate and the forceps broader proximad and much more elongate, with proximo-internal flange terminating in a sharp tooth. From examination of the macrolabic and brachylabic phases developed in three other species of the genus before us, we find that the pronotum is normally slightly broader in the former than in the latter condition of the same species.

This insect shows decided variation not only in size but also in coloration.

[1] Burr, later realizing that this name did not agree in gender with *Forficula*, changed it to *aceris*. The feminine of the Latin adjective *acer* is, however, *acris*.

[2] See Burr's discussion and figure, Fauna. Br. India, Dermaptera, p. 168, and Pl. VII. fig. 57.

[3] *Ibid.*, p. 172 and Pl. VII, fig. 60.

Measurements (in millimeters) of specimens from Shillong.

Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of exposed portion of wing	Length of forceps	Length of margin of proximo-internal flange of forceps
Male—						
7·8	1·22	1·50	2·58	1·16	3·24	1·02
7·9	1·25	1·50	2·45	1·16	3·60	1·16
9·0	1·46	1·73	2·70	1·25	3·60	1·22
10·0[1]	1·52	1·80	2·92	1·32	4·70	1·36
10·7	1·52	1·80	2·90	1·32	6·10	1·63
10·5	1·50	1·85	2·92	1·20	7·60	1·80
Female—						
8·8	1·34	1·60	2·55	1·06	2·86	..
9·7	1·40	1·70	2·79	1·25	3·00	..

In this species the male pygidium is convex declivent, terminating in a brief horizontal flange, the apex truncate and, in the brachylabic phase, distinctly narrower than the horizontal distance occupied by the pygidium. In the macrolabic phase the pygidium is decidedly more elongate and proportionately more slender.

Three males and one female have one of the arms of the forceps much shorter than the other, deformed, in the males lacking the proximo-internal flange.

The majority of the series are shining blackish brown, the head and forceps slightly paler and more reddish, the tegmina and wings decidedly paler, sandford's brown, darkening gradually laterad and distad. In some specimens the head is as dark as the pronotum.

The smallest male from Shillong shows a distinctive colour phase. The head is ochraceous tawny, the pronotum blackish brown and the tegmina and wings clay colour. The abdomen is chestnut brown proximad paling to hazel distad, with distal extremity blackish brown. The forceps are rich chestnut brown, the limbs dark. The female from Kulu is an even more striking example of this contrastingly coloured phase, agreeing with the male except that the

[1] The majority of the males before us agree more nearly with this individual.

head is light ochraceous tawny, the tegmina and wings antimony yellow, with pronotum very narrowly marked with this colour laterad.

Forficula interrogans Burr.

1905. *Forficula interrogans* Burr, Ent. Mo. Mag. (2), XVI, p. 85, (♂; Darjiling, India.]

Kurseong, Northern Bengal (from C. Leigh), one male, six females.

We are by no means satisfied that *interrogans* will not eventually prove to be a synonym of *planicollis* (Kirby)[1]. The present material fits decidedly more closely Burr's analysis of *interrogans*[2] than it does his discussion of *planicollis*[3] and, without more material, we believe that we should therefore record it as such.

Length of body, male 6·1, female 6 to 7·3; length of pronotum, male 1·1, female 1·09 to 1·15; greatest width of pronotum, male 1·39, female 1·34 to 1·4; length of tegmen male 2·2, female 2·13 to 2·24; length of exposed portion of wing, male 0·88, female 1·02 to 0·61; length of forceps, male 2, female 1·7 to 1·57, length of margin of proximo-internal flange of male forceps 0·54 mm.

Opisthocosmiinæ.

Sadiya, new genus.

This genus is erected to include the new species, *S. grata* here described, and the African *pœcilocera* (Borg)[4]. It is nearest in relationship to *Dinex*[5] Burr and *Thalperus* Burr[6].

These genera agree in having fully developed tegmina which lack keels, ultimate male tergite narrow, narrowing and sloping decidedly caudad, pronotum approximately as broad as long and caudal metatarsus slightly longer than the combined length of the succeeding joints, though appreciably less than twice as long as the third joint.

We agree fully with Burr in his definition of *Opisthocosmia* in its restricted sense. The genotype, *O. centurio* Dohrn, may be readily distinguished from

[1] Described from a female from North India, *Jour. Linn. Soc. London*, XXIII, p. 525, (1891).

[2] Fauna Br. India, Dermaptera, p. 173, Pl. VII, fig. 61.

[3] *Ibid.*, p. 174.

[4] A male before us from the Belgian Congo, belongs to the Philadelphia Academy. Originally referred to the genus *Ancistrogaster*, Burr has assigned the species, with a query, to *Opisthocosmia*.

[5] Comparison is made with two males and a female of the genotype, *D. americanus* (Bormans), from Guatemala and Panama, in the Hebard Collection.

[6] Comparison is made with a male of the genotype, *T. kuhlgatzi* (Burr), from the Belgian Congo, in the collection of the Philadelphia Academy.

Sadiya by its very large size, pronotum which is very much longer than wide (though it agrees in being narrower caudad than cephalad), the very elongate limbs and ultimate male tergite which is strongly transverse and scarcely narrows caudad.[1]

From *Dinex* the present genus differs in its more compact, less elongate form, head more evenly tumid (without a marked or extensive concave area mesad on the occiput), decidedly shorter antennal segments, pronotum with lateral margins convergent caudad throughout (not very weakly convex and convergent caudad only in caudal two-thirds), decidedly shorter limbs and caudal metatarsus decidedly longer than the last joint (not equalling that joint in length). In contour these genera agree very closely except for the general decidedly greater attenuation and more intricate specialization of the male forceps in *Dinex*. This similarity is particularly emphasized by the striking smallness of the pronotum, when compared with the size of the head and tegmina.

From *Thalperus* the present genus differs in showing not even weak flattening, in the somewhat tumid head, more elongate antennal segments and proportionately decidedly smaller pronotum with greatest width cephalad and lateral margins convergent caudad (not feebly convex and sub-parallel).[2]

Though showing nearer affinity to *Dinex* in general contour, *Sadiya* agrees with *Thalperus* in the greater number of characters which are used to separate the genera of this sub-family.

Genotype. *Sadiya grata*, new species.

Generic description. Size small for the subfamily, form slender and showing no flattening. Head moderately tumid with sutures sub-obsolete. Antennæ with segments moderately elongate, fourth segment slightly longer than third. Pronotum very small, length approximating width, lateral margins convergent caudad so that the cephalic is distinctly greater than the caudal width, caudal margin convex. Tegmina and wings fully developed; the former broad, full and with dorsal surface weakly convex, lacking keels, caudal margin transverse, truncate.

[1] We are able to determine this from the following material of *O. centurio* Dohrn, kindly loaned to us from the Burr Collection, by the British Museum:—

Borneo (Freivaldsky), one male, see Plate XXI, figure 24.

Padang Pandjang, Western Sumatra (from H. Rolle), one female.

See also Bormans, Das Tierreich, XI, p. 95, fig. 36*a*, *b* and *c*, (19), and Burr, Gen. Ins., Dermaptera, Fasc. 122, p. 92, Pl. IX, figs. 13, 13*a* and 13*b* (1911).

[2] For some unknown reason Burr has placed the genus *Thalperus* in his key in the category in which the ultimate male tergite is transverse, rectangular and rather depressed, Gen. Ins., Dermaptera, Fasc. 122, p. 89 (1911). This is incorrect, as shown by the specimen of *kuhlgatzi* before us.

Abdomen with surface decidedly convex, glandular folds of second tergite small, of third tergite very large, greatest width meso-caudad, ultimate tergite narrow, tapering and strongly declivent caudad in both sexes. Male forceps sub-attingent throughout, nearly straight, without large teeth ; female forceps more slender and straight to the weakly incurved apices. Limbs moderately elongate, caudal metatarsus longer than combined length of succeeding joints, third joint appreciably shorter.

Sadiya grata, new species. (Plate XXI, figures 25 and 26.)

This handsome little insect is readily distinguished from *S. pœcilocera* (Borg) by its distinctive coloration and the unusual contour of the forceps.

Type : male ; Sadiya, Assam, 21st to 25th May 1920 (T. Bainbrigge Fletcher). [Hebard Collection, Type No. 777.]

In addition to the characters given in the generic description, we note the following : Eye slightly longer than cheek. Head with caudal margin of occiput transverse, showing only a trace of emargination. Pronotum with cephalic angles rectangulate ; prozona moderately tumid, narrow lateral portions moderately reflexed ; lateral margins convergent caudad and almost straight, showing very weak convexity, rounding into the moderately convex caudal margin. Width of each tegmen slightly greater than greatest width of pronotum.

Abdominal tergites very minutely tuberculose laterad, except ultimate tergite which is smooth and polished, weakly tumid above the forceps with area between impressed, its caudal margin showing very weak concavity mesad. Pygidium vertical, with caudal face produced as a small, bluntly conical projection. Forceps sub-attingent, showing a weak bisinuation with acute apices overlapping when in normal position ; dorsal surface weakly convex ; weakly flattened at ventro-internal margin in proximal third and supplied with very minute teeth, thence the internal surface is weakly longitudinally striate to the apex ; ventral surface deplanate proximad, becoming shallowly concave on internal half of distal portion. Penultimate sternite with caudal margin broadly convex. Third joint of caudal tarsus three-quarters as long as the metatarsus.

Allotype : female ; same data as type. [Hebard Collection.]

Agrees closely with male in ambisexual characters, differing as follows. Abdomen slightly heavier, the tergites only slightly roughened laterad, the ultimate tergite similar but with caudal margin mesad showing a narrower but stronger emargination, which is roundly obtuse-angulate. Pygidium similar. Forceps about as long as in male but decidedly more slender, separated

by a brief interval and straight to the weakly incurved apices. Arms of forceps tapering rapidly from base to median portion, thence very slender and weakly tapering; roundly triquetrous in proximal portions, where the ventro-internal margin is very weakly sub-lamellate and sub-crenulate; ventral surface deplanate, longitudinally sub-striate, with margins weakly sub-cingulate, particularly in the median portion.

Length of body, male 7·2[1] to 8, female 8 to 8·2; length of pronotum, male 0·95 to 1·02, female 1·05 to 1·11; cephalic width of pronotum, male 1·02 to 1·12, female 1·16 to 1·09; caudal width of pronotum, male 0·95 to 1·02, female 0·98 to 0·95; length of tegmen, male 2·18 to 2·52, female 2·58 to 2·45, length of exposed portion of wing, male 1·1 to 1·36, female 1·29 to 1·16; width across tegmina, male 2·04 to 2·18, female 2·18 to 2·11; greatest width of abdomen, male 1·84 to 2·15, female 2·25 to 2·34; length of forceps male 2·72 to 2·86, female 2·65 to 2·8 mm.

Head, pronotum and abdomen (except laterad) kaiser brown, the pronotum apparently darker caudad, due to its translucence there and the darker colour of the tegmina beneath. The sides of the thoracic segments are blackish and the abdomen becomes blackish laterad, with the glandular folds black. Antennæ mars brown with ninth or tenth (terminal[2]) segment buffy. Tegmina chestnut brown, with a broad longitudinal paler area (antimony yellow in the type, tawny in the other specimens) extending caudad fully half the distance to the caudal margin. The outline of this marking is vague. Exposed portion of wings chestnut brown in internal half, antimony yellow in external half, the apex of the pale area roundly terminating and situated before the apex of the wing. Forceps in the males chestnut brown, paling to russet proximad and distad; in the females russet. Underparts russet. Limbs immaculate, ochraceous tawny.

In addition to the type and allotype, a paratypic pair are at hand, taken at Margherita, Assam, 14th to 19th May 1920, by T. Bainbrigge Fletcher.

Prosadiya, new genus.

This genus includes the single species, *P. tricota*, here described. In general appearance it resembles *Sadiya*, the forceps being likewise unusually simple and straight for the subfamily, but longer and more slender, in that respect showing closer similarity to *Dinex*. The pronotum in *Prosadiya* is,

[1] The measurements of the type male and allotype female are given first, those of a paratypic pair last.

[2] The antennæ may be incomplete in the three specimens before us showing the buffy terminal segment.

however, much larger in proportion to the body bulk than in those genera, in this feature showing closer agreement with *Thalperus.*

Nearest relationship is shown to *Sadiya.* These genera agree in general contour, in having fully developed organs of flight, tegmina without keels, ultimate male tergite narrow and narrowing caudad, pronotum approximately as broad as long and caudal metatarsus slightly longer than the combined length of the succeeding joints.

The present genus differs from *Sadiya* in being decidedly hirsute, in having the frons moderately and lateral portions of occiput decidedly tumid and separated by deep sutures, the pronotum larger in proportion to the size of the head and with lateral margins weakly divergent caudad, ultimate male tergite sloping moderately caudad and caudal metatarsus distinctly less than twice as long as the third joint.

Genotype.—*Prosadiya tricota,* new species.

Generic description. Size small for the subfamily, form slender and showing no flattening, surface decidedly hirsute. Head with frons moderately and lateral portions of occiput decidedly tumid and separated by deep sutures. Antennæ with segments moderately elongate for the subfamily, somewhat more elongate than in *Sadiya,* third segment approximating fourth in length.

Pronotum medium small, length approximating width, lateral margins weakly divergent caudad so that the cephalic is appreciably less than the caudal width, caudal margin convex. Tegmina and wings fully developed; the former moderately broad and with dorsal surface weakly convex, lacking keels, caudal margin transverse truncate. Abdomen with surface convex, glandular fold of third tergite minute, of fourth tergite large. Male forceps sub-attingent throughout, straight to the weakly incurved apices, without teeth. Limbs moderately elongate, caudal metatarsus longer than combined length of succeeding joints, third joint distinctly shorter than metatarsus.

Prosadiya tricota, new species. (Plate XXI, figure 27.)

Though superficially somewhat resembling *Sadiya grata* here described, the present insect is seen, on closer examination, to differ very widely in the generic features discussed above, as well as in the more elongate and slender male forceps, the strikingly bicolored head and different tegminal marking.

Type: male; Dibrugarh, Assam, 13th May 1920 (T. Bainbrigge Fletcher). [Hebard Collection, Type No. 778.]

The following characters are important in defining the species, in addition to those given in the generic discussion: Eye slightly longer than cheek. Head with caudal margin of occiput transverse, showing only a trace of

emargination. Pronotum with cephalic angles very slightly more than rectangulate; prozona moderately tumid, lateral portions moderately reflexed, though not as much as in *S. grata;* lateral margins very weakly divergent caudad and almost straight, showing very faint convexity, rounding into the rather broadly convex caudal margin. Width of each tegmen appreciably less than least width of pronotum.

Entire abdominal surface very minutely pitted, these the bases of very fine hairs which cover the entire insect and give it a fuzzy appearance, these hairs being even more numerous on the abdomen than elsewhere; ultimate tergite not as narrow and not as decidedly declivent caudad as in *S. grata*, surface evenly convex except for twin, faintly concave areas meso-caudad, with a very short, longitudinal, median, impressed line proximad between these.

Pygidium declivent, sloping ventro-caudad, narrow and fitting tightly between the arms of the forceps, with caudal face deplanate. Forceps attingent beyond the very narrowly separated bases, elongate, slender and straight to the very broadly incurved acute apices, which in normal position overlap; simple and cylindrical except for a very low delicate, rounded ridge on the dorso-internal margin, which, directed meso-dorsad, runs from the basal fourth to near the base of the forceps. This ridge develops rapidly proximad, then weakens and disappears gradually distad, while the dorso-internal margin distad and the greater portion of the ventro-internal margin is defined by a very fine raised line. Penultimate sternite with caudal margin broadly convex. Third caudal tarsal joint two-thirds as long as the metatarsus.

Length of body 6·3, length of pronotum 1·12, cephalic width of pronotum 1·02, caudal width of pronotum 1·19, length of tegmen 2·29, length of exposed portion of wing 1·12, width across tegmina 1·95, greatest width of abdomen 1·74, length of forceps 3·44 mm.

Head with frons and mouthparts blackish chestnut brown, occiput cinnamon-rufous in sharp contrast. Eyes black. Pronotum with prozona cinnamon-rufous, the remaining lateral and caudal portions transparent, buffy yellow. Tegmina mars brown, with an oval spot of antimony yellow meso-proximad in the dorsal field. Exposed portion of wings antimony yellow, broadly suffused with mars brown in proximal half of sutural margin, this suffusion sub-obsolete beyond, but running diagonally to the external angle of the tip, where it again becomes distinct. Abdomen tawny proximad, rapidly deepening to mars brown in distal portions. Forceps ochraceous tawny, ventral surface slightly darker. Limbs clear translucent buffy yellow.

The type of this remarkable earwig is unique.

Pareparchus pelvimeter, new species. (Plate XXI, figure 28.)

Though small for the subfamily, this insect is very much larger than the genotype, *P. minusculus* (Bormans).

These species are quickly distinguished from the other known forms of the Opisthocosmiinæ by the comparatively short antennal segments, transverse and almost semicircular pronotum and transverse ultimate tergite of the male.

Type: male; Hansey Estate, Sanivarsandai, Coorg, India, 29th to 30th April 1913 (T. V. Ramakrishna Ayyar). [Hebard Collection, Type No. 780.]

Size small for the subfamily, form slender. Head weakly convex, sutures sub-obsolete, caudal margin of occiput transverse, with only a trace of convexity on each side. Eye small, only three-fifths as long as cheek. Antennæ with segments comparatively short, first as long as second, third and two-thirds of fourth, second quadrate, third slightly over twice as long as second, fourth as long as third, fifth decidedly longer and showing a decidedly pyriform tendency.

Pronotum semicircular, distinctly broader than long; prozona weakly tumid, other portions deplanate, except for the lateral portions, which are very weakly reflexed. Tegmina and wings fully developed; the former without keels, with caudal margin transverse and showing very faint concavity. Abdomen slightly the widest meso-distad, almost parallel-sided; glandular folds of third tergite very small and poorly developed, of fourth tergite represented by low, rounded knobs; surface impresso-punctulate, these weak dorso-proximad and very decided on the four distal tergites laterad. Ultimate tergite transverse, sloping moderately caudad, the lateral margins showing very weak convergence caudad; surface impresso-punctulate but with four narrow longitudinal smooth areas, very weakly tumid distad at bases of forceps with caudal margin bluntly produced there, weakly concave between and on each side with caudal margin there weakly concave.

Pygidium vertical, showing mesad a slight flexure ventro-cephalad, its surface smooth. Forceps showing an inward curvature at base, becoming attingent, thence evenly diverging to distal portions, which are curved inward so that the apices meet; armed just beyond area of contact with a very large, blunt, dorsal tooth, which is directed dorso-caudad, with base strongly longitudinal. The arm is flattened dorsad in brief proximal portion before this tooth and rounded but showing a quadrate tendency in distal portions, due to a weak flattening of the internal surface and the very weak convexity of the dorsal surface. Surface of forceps with minute scattered impressed punctæ, except on internal surface to beyond median point and ventral surface proximad, where minute tubercles occur, the ventro-internal margin armed with heavier

minute blunt teeth along area of contact and with fewer small tubercles to beyond median point. Penultimate sternite with distal margin convex, the convexity strongest mesad, rather decidedly hirsute in distal portion. Limbs rather short and slender. Caudal metatarsus equal in length to third joint and pilose ventrad, second joint strongly dilated.

A paratypic male before us shows a more strongly macrolabic type. The forceps are more elongate, with the large dorsal tooth, the small blunt ventro-internal teeth and the minute tuberculations all more decided.

Length of body[1] 8·3 to 9[2], length of pronotum 0·88 to 1·16, greatest (cephalic) width of pronotum 1·18 to 1·1, length of tegmen 2·27 to 2·52, width across tegmina 1·9 to 2, length of exposed portion of wing 1·16 to 1·18, greatest width of abdomen 2·05 to 2·11, length of forceps 2·82 to 3·55, length of tooth of forceps 0·38 to 0·61 mm.

Head, abdomen and forceps shining blackish chestnut brown. Antennæ and tegmina dark chestnut-brown. Pronotum with prozona very dark, shining, chestnut brown, the lateral and caudal portions translucent honey yellow, caudad of the prozona tinged with brown. Exposed portions of wings honey yellow, rather broadly suffused about the free margins with brown, except at the proximo-internal portion of the apex. Limbs buff, tinged with tawny, the tibiæ suffused with chestnut brown to near their apices, the caudal femora suffused with chestnut brown in proximal two-thirds. The median femora also show a trace of brown suffusion in proximal two-thirds. The paratype is similar in coloration, though slightly more recessive with proximal abdominal tergites becoming chestnut brown proximad and suffusions on the limbs weaker.

In addition to the type, a paratypic male is before us, taken at Manantoddy, Wynaad, at 2,500 feet, on 16th November 1917 by Y. R. Rao.

Eparchus inermis, new species. (Plate XXI, figure 29.)

This insect agrees closely with *E. insignis* (Haan) in size, colour, pattern and form, except that in the male the abdominal tergites are unspecialized laterad and the forceps are weakly bisinuate and entirely lack large teeth or projections. The individual at hand is also darker than any of the specimens of *insignis* before us.

The species in many ways resembles *Narberia simplex* (Bormans)[3], that insect being larger, with pronotum longer than broad, the sides of the fifth to

[1] The measurements of the type are given first.

[2] This specimen is distended. The length is, therefore, estimated.

[3] Described in 1894, later diagnosed by Burr, from material of the type series as *Hypurgus simplex*, Fauna Br. India, Dermaptera, p. 189, (1910).

eighth tergites recurved and sharp when seen from above and the forcep shorter.

Type: male; Shillong, Khasi Hills, Assam, October 1920 (T. Bainbrigge Fletcher). [Hebard Collection, Type No. 779.]

Size medium for the genus. Head with frons moderately tumid and showing two impressed points between the eyes, occiput with an irregular transverse impression meso-caudad as in *insignis*. Pronotum with length nearly equal to width, greatest width meso-cephalad, lateral and caudal margins very broadly convex; prozona moderately tumid, with a medio-longitudinal linear sulcus and an impressed point mesad on each side, lateral portions moderately reflexed, caudal portion deplanate. Tegmina and wings fully developed; the former much wider than the pronotum, lacking keels, full, with dorsal surface weakly convex and caudal margin transverse.

Abdomen with surface very minutely punctulate, except ultimate tergite which is smooth; glandular folds of third tergite medium, of fourth tergite large, the other tergites unspecialized, fifth and sixth increasing in width, the seventh, eighth and ninth decreasing more rapidly in width and telescoping as the abdomen rapidly narrows. Ultimate tergite as in *insignis;* narrow, narrowing and decidedly declivent caudad, with surface tumid distad above arms of forceps and concave between.

Forceps elongate and slender, arms weakly convergent until they touch proximad, thence curving very weakly and diverging until separated a distance slightly more than the width of one of the arms, where they curve broadly inward to the overlapping, acute apices. Arms cylindrical, with a sub-obsolete low rounded ridge along the ventro-internal margin proximad, with a median row of very minute, widely spaced denticulations along the internal surface and slightly thickened ventro-mesad toward the apex, this the vestige of the homologous tooth found in *insignis*. Penultimate sternite with caudal margin very broadly convex. Caudal metatarsus very elongate, third joint three-fifths as long as metatarsus.

Length of body 9·3, length of pronotum 1·43, greatest (meso-cephalic) width of pronotum 1·54, length of tegmen 3·2, dorsal width of tegmen 1·4, length of exposed portion of wing 1·56, greatest width of abdomen 2·92, length of forceps 6·1, length of caudal metatarsus 1·09, length of third caudal tarsal joint 0·75 mm.

Head, proximal antennal segments (the others are missing), pronotum and limbs shining blackish, showing scarcely a tinge of brown. Tegmina and wings blackish chestnut brown, the latter with a large meso-proximal spot of mustard yellow. Abdomen blackish chestnut brown, the tergites and sternites

laterad and in meso distal portions almost black. Forceps chestnut brown, except in thickened portion before the apex, which is blackish.

The type is unique.

Eparchus insignis (Haan).

1842. *Forficula insignis* Haan, in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 243, Ins. Pl. 23, fig. 14. [♂, ♀; Java.]

Phoobsering, Lebong, Sikkim, 5,000 feet, September 1910 (H. M. Lefroy), one female.

Pollibetta, Coorg, 24th October to 16th November 1915 (T. Bainbrigge Fletcher), one male.

Sidapur, Coorg, 7th August 1917 (Y. R. Rao), one female.

Yercaud, Shevaroy Hills, Madras Presidency, 3,000 to 5,000 feet, 9th August 1917, (Y. R. Rao), one female.

In the male only, of the present material, do the exposed portions of the wings show conspicuously the yellow proximo-internal spot and the line of the same colour along the sutural margin at the apex.

Timomenus oannes (Burr).

1900. *Opisthocosmia oannes* Burr, Ann. Mag. Nat. Hist., (7), VI, p. 85. [♂, Assam.]

Shillong, Khasi Hills, Assam, 5,000 feet, 31st May to October 1916 to 1919 (Fletcher and Rao), five males, four females.

The wings of this very handsome species, when expanded, are seen to be deep chrome, suffused with black in the distal portions.

Length of body, male 11·7 to 14, female 10·8 to 12; length of pronotum, male 1·56 to 1·77, female 1·65 to 1·7; greatest (meso-cephalic) width of pronotum, male 1·77 to 1·97, female 1·9 to 1·88; length of tegmen, male 3·2 to 3·5, female 3·5 to 3·55; length of exposed portion of wing, male 1·36 to 1·56, female 1·43 to 1·63; length of forceps, male 5 to 7, female 6·4 to 6·4 mm.

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Fig. 1. *Diplatys bicoloripes*, new species. Male, *type*. Nagpur, Central Provinces, India. Dorsal view. (× 6·66.)

„ 2. *Diplatys bicoloripes*, new species. Male, *type*. Nagpur, Central Provinces, India. Ventral view of distal portion of abdomen and forceps. (Much enlarged.)

„ 3. *Paralabis greeni* (Burr). Male, *type*. Pundalu-oya, Ceylon. Dorsal view of ultimate tergite and forceps. (Much enlarged.)

„ 4. *Paralabis castetsi* (Bolivar). Male. Kodaikanal, Madras Presidency, India. Dorsal view of ultimate tergite and forceps. (Same scale as figure 3.)

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„ 8. *Nala lividipes* (Dufour). Male. Haripur Hazara, North-West Frontier Province. Dorsal view of ultimate tergite and forceps. (Same scale as figure 7.)

„ 9. *Nala lividipes* (Dufour). Male. Pusa, Bihar, India. Dorsal view of ultimate tergite and forceps. (Same scale as figure 7.)

„ 10. *Chætospania kurseongæ*, new species. Male, *type*. Kurseong, Northern Bengal, India. Dorsal view of ultimate tergite, pygidium and forceps. (Much enlarged.)

„ 11. *Chætospania kurseongæ*, new species. Female, *allotype*. Kurseong, Northern Bengal, India. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 10.)

„ 12. *Chætospania stiletta* Burr. Male. Kodaikanal, Madras Presidency, India. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 10.)

Fig. 13. *Chætospania stiletta* Burr. Female. Kodaikanal, Madras Presidency, India. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 10.)

Plate XX.

Fig.14. *Exypnus koorgensis*, new species. Male, *type*. Sidapur, Coorg, India. Dorsal view of ultimate tergite, pygidium and forceps. (Much enlarged.)

„ 15. *Exypnus koorgensis*, new species. Male, *paratype*. Brachylabic condition. Sidapur, Coorg, India. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 14.)

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„ 17. *Proreus fletcheri*, new species. Male, *type*. Goalundo to Gauhati, Brahmaputra River, Eastern Bengal, India. Lateral outline of distal antennal segments. (Greatly enlarged.)

„ 18. *Cranopygia pluto*, new species. Male, *type*. Chin Hills, Burma. Dorsal view. (× 3·3.)

„ 19. *Anechura stoliczkai* Burr. Male. Kulu, Kangra, Punjab, India. Dorsal view of ultimate tergite, pygidium and forceps. (Much enlarged.)

„ 20. *Anechura stoliczkai* Burr. Male. Brachylabic condition. Jallore Pass, Kulu, Kangra, Punjab, India. Dorsal view of ultimate tergite and forceps. (Same scale as figure 1.)

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„ 23. *Forficula lebongae*, new species. Male, *type* Phoobsering, Lebong, Sikkim. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 21.)

Plate XXI

Fig. 24. *Opisthocosmia centurio* Dohrn. Male. Borneo. Lateral view of distal portion of abdomen and forceps. (Much enlarged.)

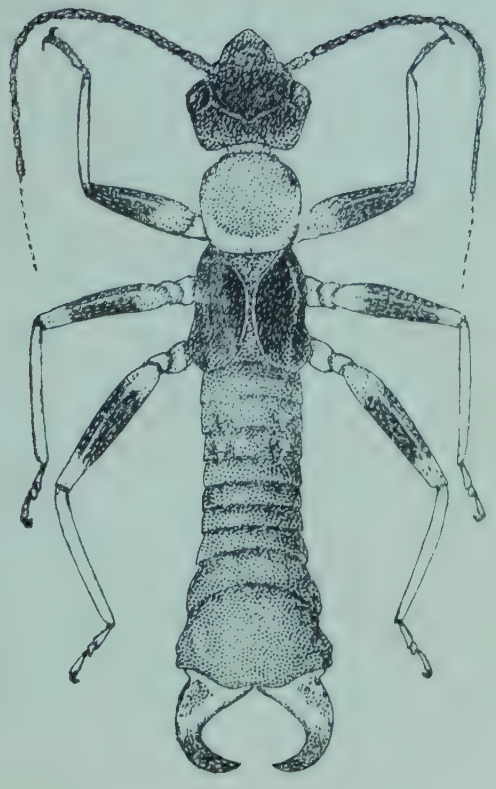
„ 25. *Sadiya grata*, new species. Male, *type*. Sadiya, Assam. Dorsal view. (× 6·66.)

Fig. 26. *Sadiya grata*, new species. Female, *allotype*. Sadiya, Assam. Dorsal view of ultimate tergite, pygidium and forceps. (Much enlarged.)

„ 27. *Prosadiya tricota*, new species. Male, *type*. Dibrugarh, Assam. Dorsal view. (× 6·66.)

„ 28. *Pareparchus pelvimeter*, new species. Male, *type*. Hansey Estate, Coorg, India. Dorsal view. (× 6·66.)

„ 29. *Eparchus inermis*, new species. Male, *type*. Shillong, Khasi Hills, Assam. Dorsal view of ultimate tergite and forceps. (Much enlarged.)



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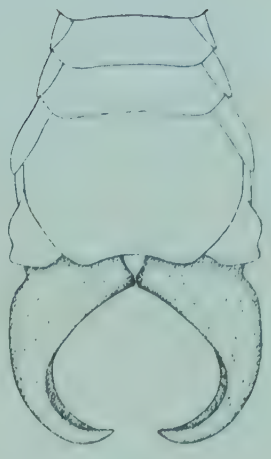

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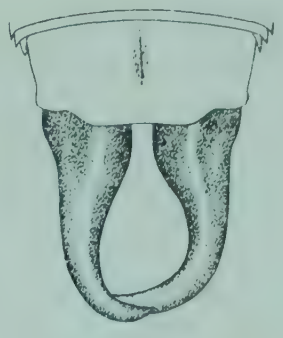

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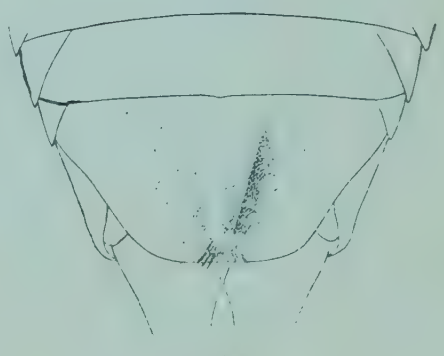

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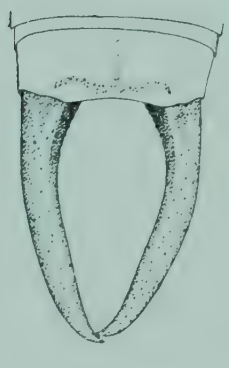

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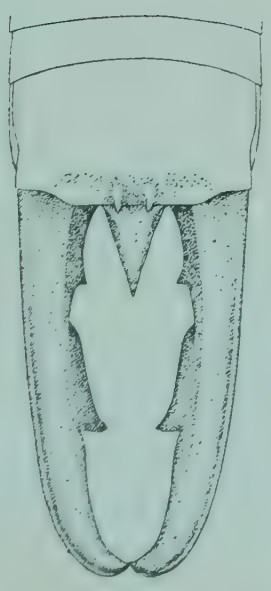

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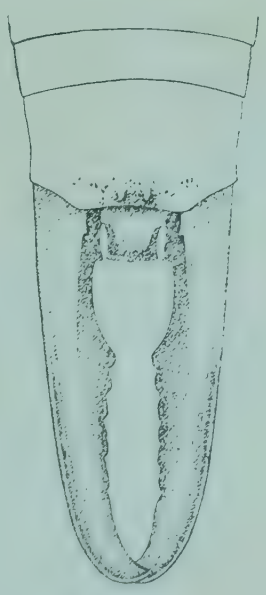

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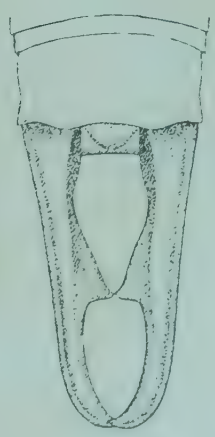

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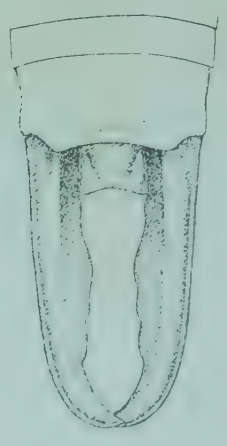

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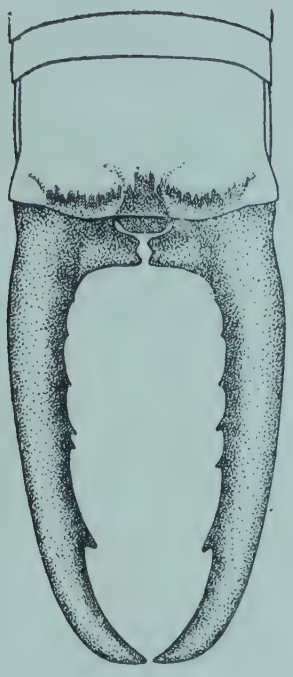

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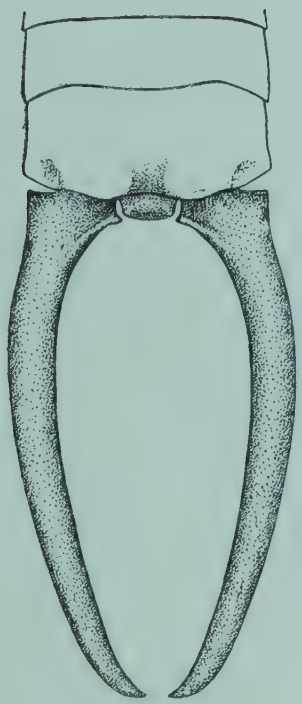

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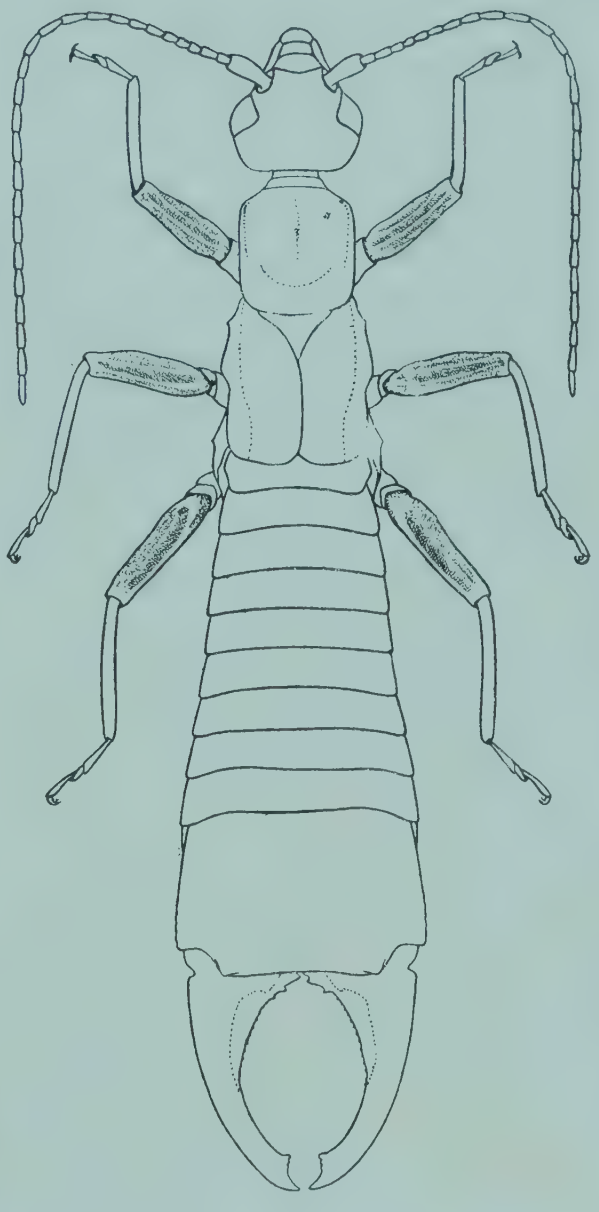

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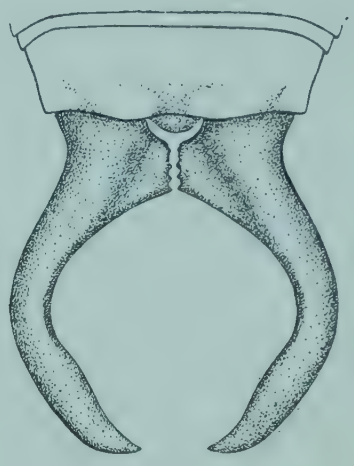

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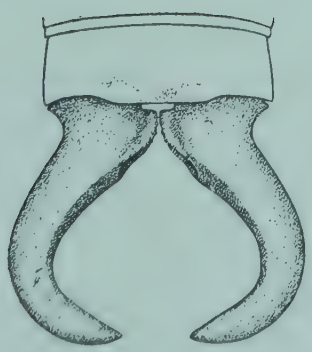

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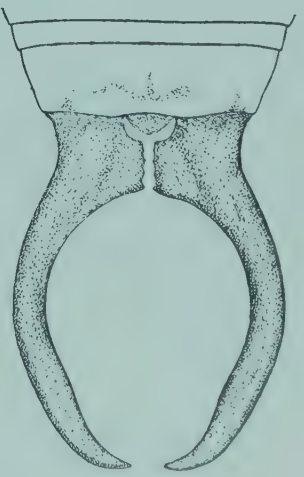

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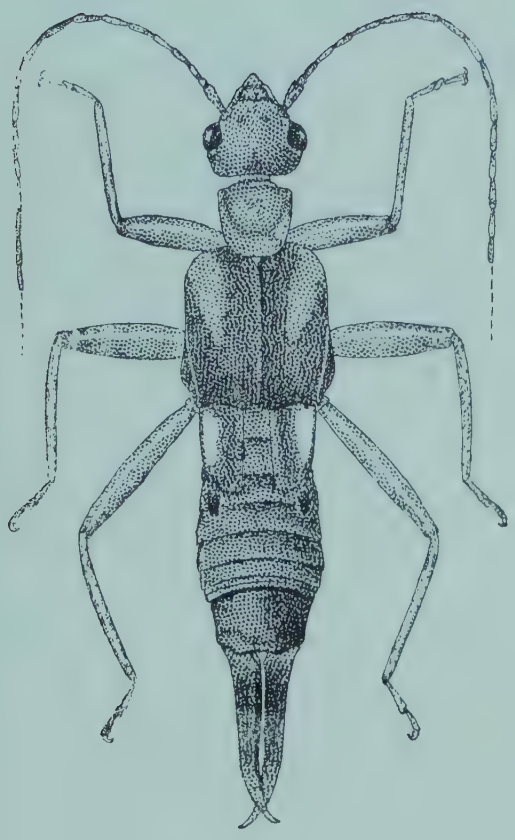

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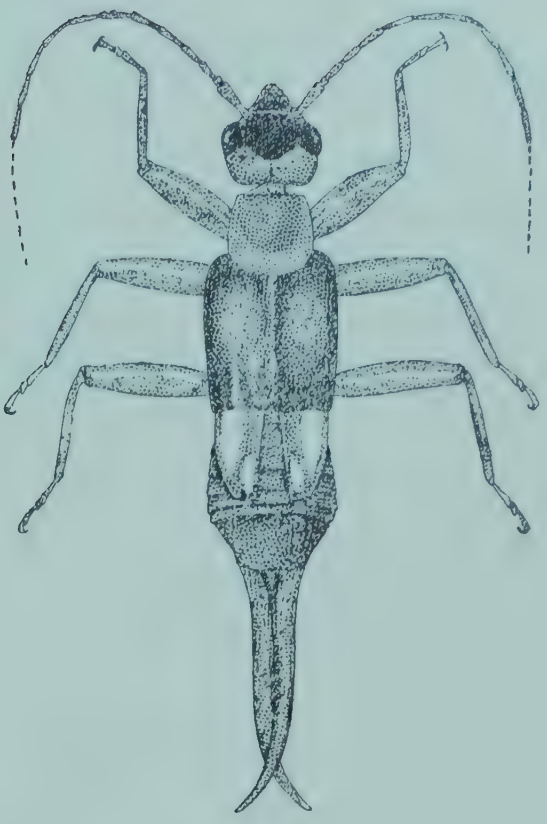

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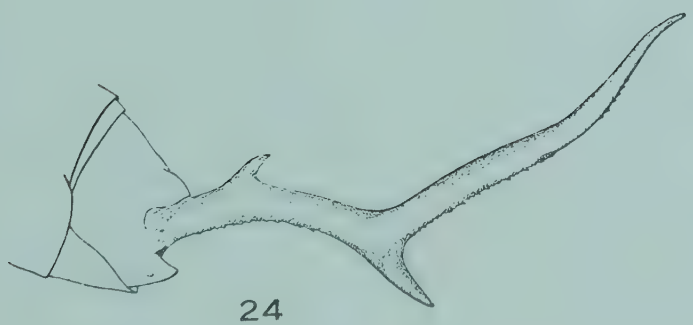

24

AN ACCOUNT OF EXPERIMENTS ON THE CONTROL OF *SIGA (SCHŒNOBIUS) INCERTELLUS* IN THE GODAVARI DELTA

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I. Introduction.

Of all the pests from which paddy suffers, the paddy stem borer *Schœnobius incertellus (bipunctifer)* is the most persistent. Although *Spodoptera mauritia* does more damage when it appears, it is much more sporadic in its habits and is generally limited to one time of the year. *S. incertellus*, on the other hand, is always to be found wherever paddy is grown in the East and it has been estimated that it causes an annual loss of 10 per cent. of the entire Indian paddy crop. The amount of damage to particular fields and districts has been estimated at as much as 60 per cent., but estimates not based on a number of counts must be regarded with caution. The characteristic white and dead ear-heads which are the signs of the presence of *Schœnobius* in the crop catch the eye, and a field which is perhaps only 3–4 per cent. attacked appears to be very much worse than it really is. The life-history cycle is too well known to need more than a passing mention here. Suffice it to say that eggs are laid in masses covered with hair on the leaves of the paddy plants. From these the young larvæ on hatching distribute themselves and bore into the developing stems. Pupation takes place in the stem. The length of life cycle is about 5 weeks.

Various schemes have been put forward for controlling *Schœnobius*, of which that most often advocated is the use of light traps. The writer is very doubtful about the efficacy of these traps. They are expensive. They are liable to be stolen. Moths are not attracted to them on moonlight nights and moreover a certain proportion of the moths have laid their eggs before they

are caught. Others again are only attracted towards the light and rest near it and lay their eggs on the surrounding paddy. At certain seasons of the year it is a pure waste of money to keep light traps burning as practically no moths are flying. What these periods are has not been worked out yet for any except part of the Godavari Delta and those dates require confirmation. It is a matter of first importance when dealing with control measures for insect pests in such a country as India, where capital is scarce, to try and adapt some local agricultural practice to one's needs. In this way the conservatism of the *raiyat* is not shocked and existing habits need not be disturbed. More important than anything else, any control must be cheap. The methods of control of the paddy stem borer put forward in this paper are the result of an attempt to fulfil the above conditions in the Godavari Delta. It is very improbable that they could be used in other paddy growing tracts in the Presidency, such as Malabar, for example, where there is not much transplanted paddy and in the Southern parts of which district *Schœnobius* is reported to be a very serious pest. The suggestions put forward here apply then only to the Delta area where the paddy is all transplanted and single seedling transplantation is the rule.

Paddy crop in the Delta. Two crops of paddy are raised annually in the Delta. They are known as the *Sarva* and the *Dalwa* crops. The *Sarva* is the long crop and lasts from July to December or early January; the *Dalwa* from January to May. The time of transplanting depends on the receipt of water from the Godavari canals and takes place in July and January–February. A certain amount of short duration paddy is grown for the *Sarva* crop. The *Dalwa* is always a short crop. Certain tracts cannot get water for the *Dalwa* season, in which case dry crops of pulses, etc., are grown. *Dhaincha* is usually sown in the standing paddy and ploughed in as manure for the succeeding crop. There is an interval between the *Dalwa* or second crop and the first crop, but between first and second crops there is no interval, the seed beds for the second crop being prepared before the harvest of the first. There is therefore a continuous food-supply for the stem borer from June to July of one year to May of the next. From May to July the fields are dry but there is always some water standing during the rest of the year and there is often a ratoon crop springing from the stubble between one harvest and the next transplanting. The whole Delta is flat and very little above sea-level. Irrigation is from canals which are fed by the Godavari river. The chief rainfall is from the North-east monsoon which breaks in October–November. There is some rain in July from the South-west monsoon which may be of assistance in preparing the seed beds for the *Sarva* crop.

In 1918-1919 numerous complaints had been received from the Collector of Kistna District and from *raiyats* about the large amount of damage done by *Schœnobius* and *Spodoptera*. A campaign was arranged to demonstrate the use of light traps for *Schœnobius* and flooding and so on for *Spodoptera*. This had to be abandoned owing to lack of staff. Later, after a motion in the Legislative Council that a grant of Rs. 10,000 should be made towards the cost of a demonstration amongst the *raiyats* in the Delta, another campaign had hurriedly to be arranged. This was limited to *Spodoptera* control but at the same time a site was looked for where work on *Schœnobius* could be carried on on a large scale which could act at once as an experiment and a demonstration. There was some difficulty in finding the necessary staff for the work as the whole activities of the Entomological Section were engaged by cotton. In the end and after some time had been wasted owing to illness and subsequent resignation of one of the staff selected, work began in earnest in 1920.

The site selected for the work was at Podalada village in Tanuku *Taluq* in the Godavari Delta (Kistna District). A *raiyat* there who owned about 120 acres of land very kindly put it at the disposal of the Agricultural Department on the understanding that he should be indemnified in the case of loss and that the Department should pay all extra cultivation expenses. The Department was able to get water for three successive crops, that is, *Dalwa* and *Sarva* 1920 and *Dalwa* 1921. The records for *Dalwa* crop 1920 are in many ways incomplete for the reasons given above, and although losses of 60 per cent. have been reported from this area it was found that the general percentage of attack was so low that it gave no fair test of the control methods which were being tried ; in fact, it was doubtful whether any controls were necessary. Some good was done by interesting the local *raiyats* who used to come and see all that was going on, and the existence of the Department was advertised. This alone was a good thing, for the Delta areas are a great centre of the non-co-operation movement and a demonstration to the effect that Government gives as well as takes is bound to work for good.

In June 1921 the Government Farm at Samalkota, Godavari District, was selected as the most suitable site for carrying on the experiments as the writer knew from personal experience that *Schœnobius* was a serious pest there. Moreover it is a much more accessible place than the Western Delta and consequently more direct control could be exercised over any work which was in progress. A Sub-station has now been established there and experiments started with the present (1921) *Sarva* crop. As the station in Tanuku *Taluq*

has now been closed down, the present paper has been compiled showing the results obtained during the 18 months in which work was carried on there.

II. Programme of work.

(1) To ascertain the amount of damage done to each crop by *Schœnobius.*
(2) To compare damage done in the experimental area with that in the surrounding fields.
(3) To obtain a record of the dates when the moths were flying.
(4) The time of the night when moths were most active.
(5) To keep a profit and loss account so as to compare the amount of crop saved, if any, with the expenses of saving it.
(6) Search for alternative food plants.
(7) Natural enemies.
(8) To find where the insect passes the " off " season.
(9) Possibility of burning stubble after harvest or of grazing it off with cattle, with a view to destroying pupæ or larvæ left in it.
(10) Close cutting of the crop at harvest time.
(11) To find whether or no *Schœnobius* prefers one variety of paddy more than another.

The following was the scheme of work which was carried on at Podalada :—

(1) As soon as transplanting was begun boys were employed who had been taught to recognize dead hearts in the seedlings. As the seedlings were pulled up from the seed beds and bundled for being carried to the fields for transplantation, each bundle containing 300–400 seedlings was handed over to one of the boys who examined it for signs of *Schœnobius* attack and for egg-masses. All damaged seedlings were rejected and the bundles retied. The rejected seedlings were destroyed. Egg-masses and larvæ from eggs laid while the crop was in the seed-bed were thus got rid of. The chances of the crop being damaged while the ear-heads were being formed, which is the time when most damage is done, should by these means be lessened to such a degree that the loss due to *Schœnobius* would be negligible. When working the *Dalwa* crop of 1921 a large number of fresh egg-masses was found at the time of transplanting, the total being 14,033, which would mean the destruction of some 2,806,600 potential moths. In combination with seedling selection, and with the idea of destroying as many pupæ and larvæ as possible which might be

left in the stubble after harvest, close cutting of the crop was advocated. The idea of burning the stubble which had been put down as part of the programme was not found to be practicable, but will probably be tried again.

(2) A light trap, consisting of one hurricane lamp hanging over a tray containing water and kerosene was kept burning throughout the year. The number of moths caught gave an indication of emergence of fresh broods. The daily catch, when there was one, was divided into moths which had not laid eggs, spent moths, and males. The trap was situated outside the experimental area so as to keep it from interfering in any way with the control measures in operation in the experimental area.

(3) Before harvest, when it was possible to distinguish damaged earheads or dead hearts, plots ten square yards each were taken on the lines of two diagonals across the experimental area and the percentage of dead hearts in each was calculated. These added together gave the average for the whole area. Similar counts were made in surrounding fields to give an idea of the attack in non-treated areas.

The area chosen for the experiments was a compact block of some 120 acres (Fig. I) of which about 100 acres were cultivated. It is quite possible that some infection took place from surrounding fields, but on the whole the experimental area was big enough to give a sufficiently accurate idea as to the efficacy or otherwise of our methods.

The business of seedling selection is very simple and should be no more difficult to teach the *raiyats* than that of single seedling transplantation which has been so successfully propagated by the Department in the Southern districts of the Presidency. If no better results were obtained than that of reducing the loss from 10 per cent. to 5 per cent. throughout the Delta the labour involved would be worth while and the saving in money would be great. The results given hereafter are from only 18 months' work and in all probability a series of observations spread over a number of years will be required before any definite statement can be made as to the complete success of seedling selection as a control. The most that can be said at present is that it is promising and it is hoped that the work at Samalkota will confirm what was done at Podalada.

It may be noted in passing that young boys are the best to employ for examining seedling bundles. They are quick at their work, take an interest in it and are much more intelligent than adults, either men or women.

FIG. I.

III. Infestation, May 1920—May 1921.

Work began at Podalada as stated above with the *Dalwa* crop of 1920. The figures for the percentage of affected seedlings are not

available and those for the emergence of moths very incomplete. It was possible, however, to make counts of the degree of attack in the experimental and non-experimental areas before harvest; the figures for which are given in the accompanying table.

TABLE I.

Experimental area		Non-experimental area	
No. of plots	Per cent. dead ear-heads	No. of plots	Per cent. dead ear-heads
1	1·8	1	4·1
2	5·9	2	3·6
3	1·7	3	1·3
4	4·9	4	2·2
5	5·6	5	11·1
6	4·0	6	5·6
7	4·0	7	5·2
8	8·4	8	5·2
9	6·8	9	3·4
10	6·9	10	4·3
11	0·7	11	5·5
12	5·1	12	4·0
13	5·4	13	3·5
14	4·8	14	7·3
15	5·5	15	7·3
16	7·3	16	9·0
17	0·6	17	4·9
18	0·5	18	3·6
19	6·6	19	6·4
20	5·0	20	5·0

This shows an average for the experimental area 4·56 per cent. and for the non-experimental area 5·12 per cent. or a difference of about 0·6 per cent., that is to say, practically no difference at all. As, however, only 20 counts were taken in each area, I do not attach very much value to these figures.

This may have been due to the fact that the boys had to be trained and to the unsatisfactory work of the assistant who resigned. The planting of the *Sarva* crop began on 17th June 1920 and continued for five weeks, till the 27th July. The total number of dead-hearts picked out was 15,571.

TABLE II.

Average percentage of dead-hearts during week.

30-VI-20	0·075
10-VII-20	0·065
17-VII-20	0·060
24-VII-20	0·030
27-VII-20	0·020

Average 0·052 per cent. ; this is equal to about 145 seedlings an acre.

Shortly before harvest counts were made on 39 plots of 10 square yards each in the experimental area and 20 in the non-experimental area for the short duration variety, *Garikasanna vari*, and in 10 plots for the *Krishnakatukulu* or long duration variety, in each area. The average percentage of dead-hearts for the experimental area for the short crop was 0·9 per cent. and in the non-experimental area 1·25 per cent. This short crop is always very much less liable to attack than the long duration crop. For the *Krishnakatukulu* crop the counts gave 2·64 per cent. and 4·52 per cent. for the experimental and non-experimental areas respectively. The cost of the whole operation came to approximately 8 annas an acre. This would represent only a profit of a few rupees on 100 acres in view of the fact that the general loss from *Schœnobius* was so low.

Dalwa crop, 1921.

Planting began on 24th January and was finished by the 5th February. This was the crop from which while seedling selection was in progress numbers of egg-masses were found and destroyed.

Number of dead-hearts found	11,689
Average for the season of transplanting	0·042 p.c.

The total number of egg-masses collected came to 14,033.

As plenty of labour was available transplanting was rushed through quickly. This crop was harvested in May 1921. 50 plots were counted in the experimental area, and 50 in the outside fields. These gave the following figures :—

	Per cent
For the experimental area attack	0·51
For the non-experimental area	1·91

With infestation as low as this, control measures are unnecessary, nor is it possible to get an accurate idea as to whether the controls are being effectual. There is a decided difference between experimental area and non-experimental area of *Sarva* 1920 and *Dalwa* 1921, but so small is the attack in the whole neighbourhood that it is very doubtful whether the process was worth the few rupees gained by it. The cost of the work for this crop was about 6 annas an acre.

IV. Number of broods in the year.

During latter part of May 1920 the catches of moths were insignificant and lights could often not be put out owing to rain or wind. But at one light, set up on 12th—15th May, the figures were as follows :—

Males	Females gravid	Females spent	Percentage of spent
177	845	339	28·6

It will be seen that, as in 1921, there was a big brood in May.

The catches made in the light traps are recorded in Figs. II and III, Fig. II representing the season 1st May—31st December 1920, and Fig. III the *Dalwa* crop 1921 January 1st—May 31st.

Below the curves are shown in diagrammatic form the hours of moonlight throughout the year. The nights with bright moonlight between 6 p.m. and 11 p.m. are the general cause of the gaps in the curve between October and March. The biggest broods were in May 1920 and February 1921. To all intents and purposes there is a continuous emergence of moths, or moths are flying, from 1st October to the middle of March, there is then a short interval, and another big brood emerges in May. After this month very few moths are flying until the beginning of October. Figures obtained this year at Samalkota (June-October) *corroborate those from Podalada.** And a short duration variety on the Government Farm which was just ready for harvest early in September (1921) showed not a single case of *Schœnobius* attack. In Figs. II and III it will be seen that a very small proportion of males came to light.

Moths which emerge in December and January would infect the seedlings for the *Dalwa* crop, and it is hoped that by seedling selection during transplantation the March and April broods will be destroyed and the ear-heads developing during April and May will be saved. Another point about seedling selection is that it is possible to weed at the same time and in

* The main brood was however late owing to the delay in the bursting of the N-E. monsoon.

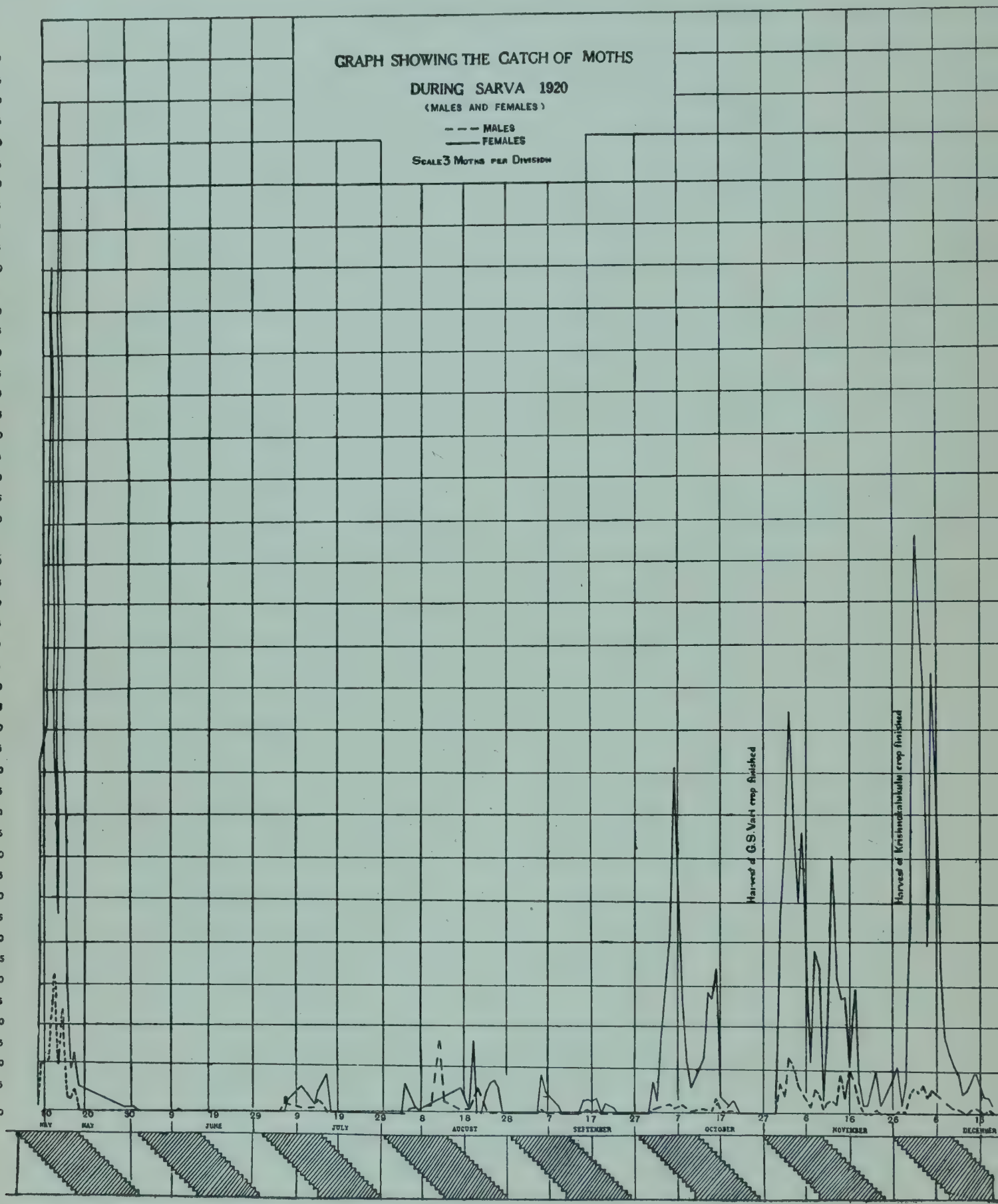
GRAPH SHOWING THE CATCH OF MOTHS
DURING SARVA 1920
(MALES AND FEMALES)
MALES
FEMALES
SCALE 3 MOTHS PER DIVISION
Harvest of G.S. Vari crop finished
Harvest of Krishnadakulu crop finished
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER

FIG. II.

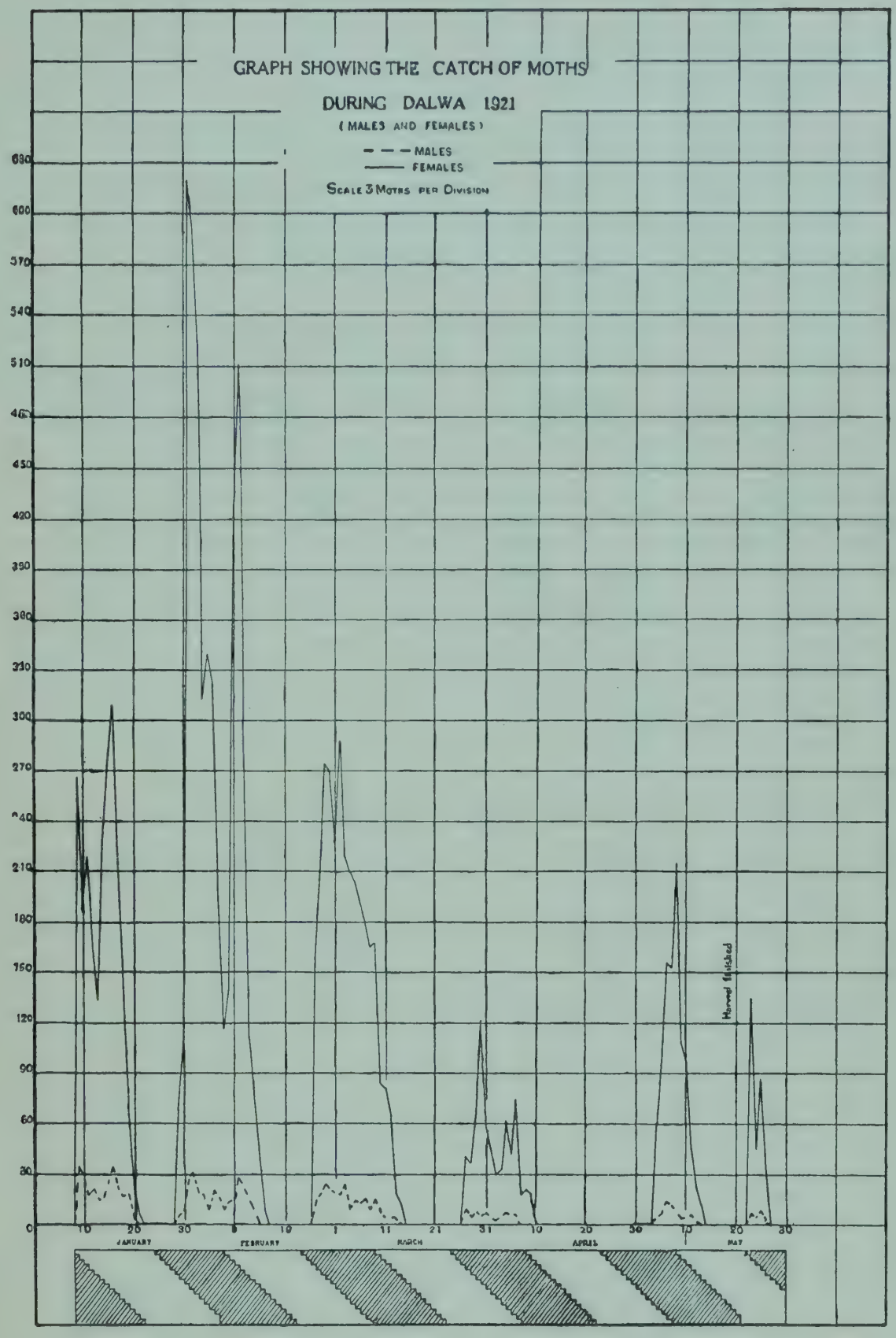

Fig. III.

this way one weeding should be saved. The cost of this weeding thus avoided should be set against the cost of the control measures. Once the crop is

transplanted and growing, it is not possible to collect damaged ear-heads or egg-masses and it has to be left alone.

V. Proportion of spent to gravid females caught.

Figs. IV and V give the proportion of spent to gravid moths caught throughout the year 1920-21. The Table shows that quite a high percentage of moths have laid their eggs before being attracted to the light.

TABLE III.

Date	Gravid moths	Spent moths	Percentage of spent to caught
October 1920 ..	600	350	36·8
November 1920 ..	1,159	702	30·5
January 1921 ..	2,285	787	25·6
February 1921 ..	3,311	1,522	31·7
March 1921 ..	1,662	799	32·4
April 1921 ..	157	172	52·2
May 1921 ..	765	499	39·4

Out of 13,640 female moths caught in these months, that is, while the two main broods are flying, 35·5 per cent. had already laid their eggs before being caught.

Time when moths fly.

Observations were made for a week at different times of the night with a view to finding the time when most moths come to the light. No moths were ever caught after 11 p.m. The number of moths caught was noted at 7 p.m., 9 p.m., 11 p.m., and 11 p.m. to 6 a.m.

The catches are given below :—

TABLE IV.

Date.	7 p. m.			9 p. m.			11 p. m. to 6 a. m.	Total between 7 p. m. & 11 p. m.		
	♂	♀ g	♀ s	♂	♀ g	♀ s		♂	♀ g	♀ s
1-II-21 ..	14	251	164	17	147	28	nil	31	398	192
2-II-21 ..	11	286	79	7	28	37	nil	18	314	116
3-II-21 ..	19	194	71	2	35	23	nil	21	229	94
4-II-21 ..	19	117	38	4	41	23	nil	23	158	61
5-II-21 ..	9	98	44	..	51	19	nil	9	149	63
6-II-21 ..	11	88	53	2	26	25	nil	13	114	78

♀g = Gravid female moths.
♀s = Spent female moths.

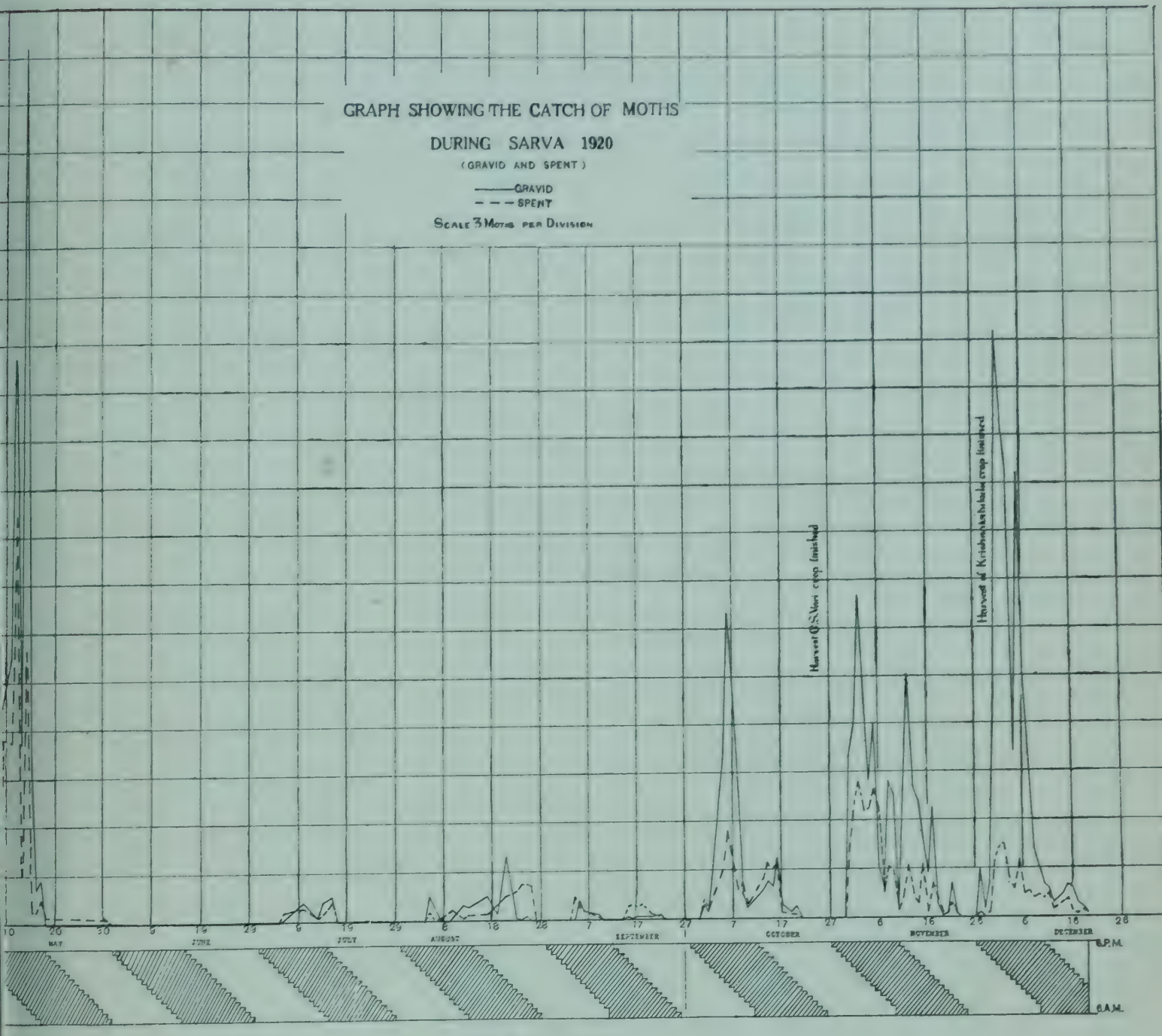

FIG. IV.

TABLE V.

3rd to 6th March 1921.

Date	7 p. m. to 9 p. m.			9 p. m.		11 p. m.	11 p. m. to 3 a. m.
	♂	♀	♀	♂	♀g	♀s	
3-III-21	19	117	38	4	41	23	
4-III-21	9	98	44	..	51	19	nil
6-III-21	11	88	53	2	26	25	

♀g = Gravid female moths
♀s = Spent female moths.

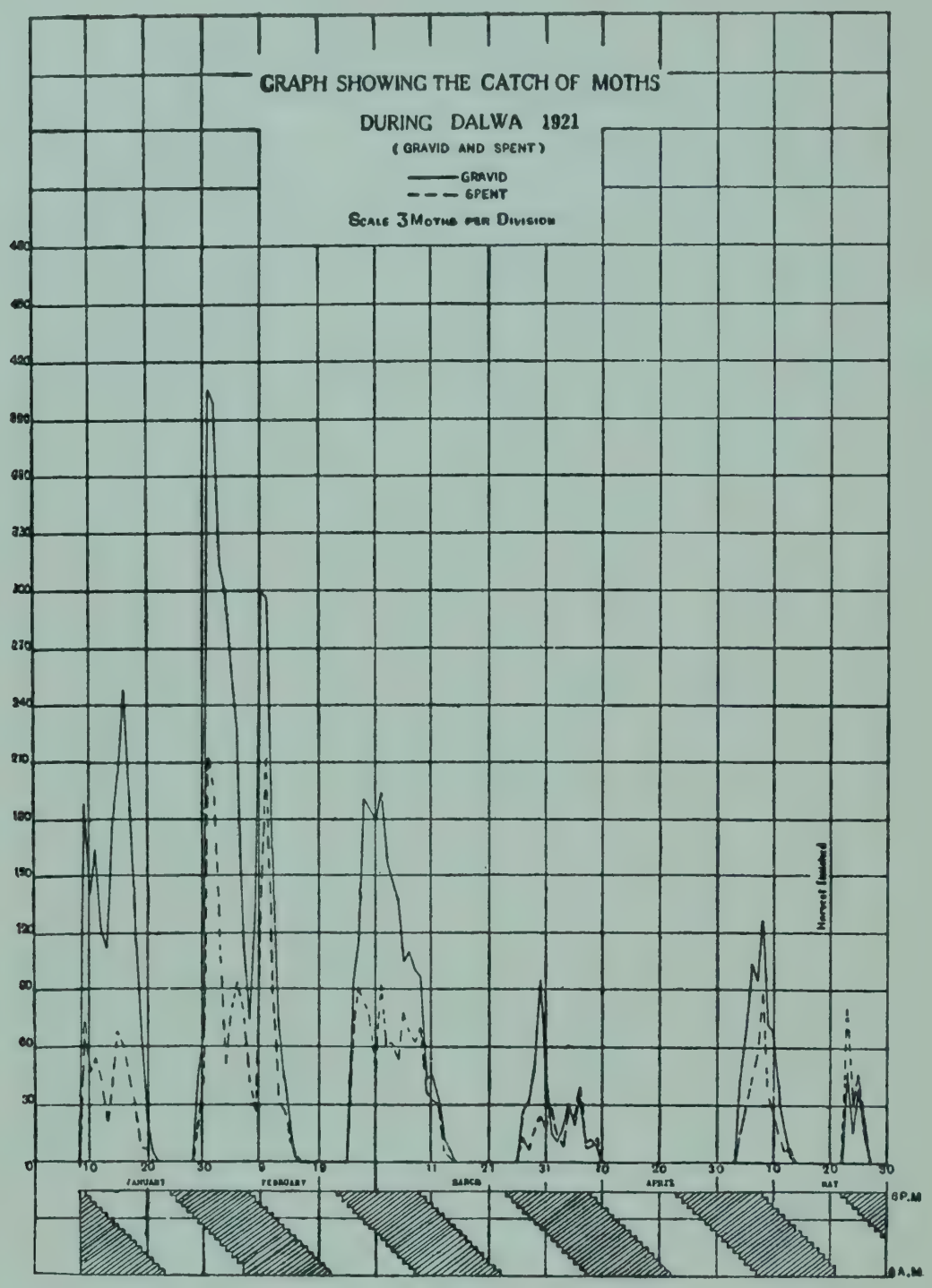

FIG. V.

VI. Close cutting and other remedies.

The idea of close cutting at the time of harvest is to prevent pupæ or larvæ which may be in the stubble from developing and giving rise to moths. It is proposed to advise close cutting in conjunction with seedling selection. By the combination of these two a very large proportion of the early generation and the last generation should be destroyed. At the time of gathering the

Sarva crop the season is generally rainy and *raiyats* are anxious to get the harvest through as quickly as possible and for this reason and from the additional labour involved close cutting is not popular. The usual practice is to leave the stubble long so that sheaves left to dry are protected from the water which is usually standing in the fields at this time of the year. It was suggested therefore that sheaves should be dried either on the *bunds* or on the drier fields. If preparation of the land for the second crop is then begun and the stubble ploughed in, any pupæ left ought to be destroyed. Burning the stubble after the second crop might be practicable.

As the fields at this time of the year (May) are dry and there is no ratooning it ought to be easy to get the fire going. As experiments at Podalada were given up with the *Dalwa* crop 1921, burning stubble was not tried on a large scale. It is not therefore certain to what extent it would be possible. Probably it will be best to cut the crop close for the *Sarva* crop and leave the stubble long for the *Dalwa* crop to facilitate the operation of burning it off. Burning stubble in this way should also destroy a certain number of moths which may be hiding in it and more again might be attracted to the fires at night.

Degree of infestation of different varieties.

One of the lines of research which it was intended to follow at Podalada was to compare amount of attack in different strains of paddy. As only two kinds were grown at Podalada, a short and a long duration variety, no comparison of this kind could be made. This work is now being followed up at Samalkota where a number of different races of paddy are being grown on the Government Farm. The difference of infestation between the two varieties grown at Podalada was due chiefly to the time of the year at which they were harvested, the long duration variety having two months more in which to become infected.

Other food plants.

No food plants other than paddy have yet been found which would assist *Schœnobius* to carry over the season when no paddy is being grown.

Natural enemies.

A Chalcid parasite has been bred from the egg-masses but is not yet identified nor has the degree of parasitism been ascertained.

VII. Measurements of larvæ at different times.

Attacked plants were periodically pulled from fields and examined for larvæ. These larvæ were measured and classed under three heads. Those

under 10 mm. in length, those over 10 mm., and those over 15 mm. This served to give further information as to when a fresh brood hatched out or another might be expected. The larval life lasts from 25–27 days and the pupal period about 7 days.

TABLE VI.

Sarva crop 1920.

Date		No. of plants examined	—10 mm.	+ 10 mm.	+ 15 mm.	Pupæ
Seedlings ..	3-VII-20	500	168	..	..	..
	10-VII-20	500	48	139	..	..
	17-VII-20	500	..	23	73	..
	24-VII-20	500	91	..	..	..
	31-VII-20	300	48	7	..	..
	2-XI-20	100	49	13	..	..
	10-XI-20	200	37	77	..	..
	18-XI-20	200	21	98	..	..
	26-XI-20	200	19	33	53	..
	1-XII-20	200	..	24	117*	..

* Crop all harvested by end of the year.

TABLE VII.

Dalwa crop 1921.

Date		No. of plants examined	—10 mm.	+10 mm.	+15 mm.	Pupæ
Seedlings ..	30-I-21	500	241	..	..	..
	5-II-21	500	149	17	..	..
	2-IV-21	200	14	104	28	..
	10-IV-21	200	..	84	49	..
	18-IV-21	200	..	18	97	..
	26-IV-21	200	51	97	14	..
	4-V-21	200	23	78	8	3
	*12-V-21	200	34	69	19	..

* Harvest.

It will be seen that at the time of transplanting the majority of the larvæ found were still not nearly ready for pupation. 48·2 per cent. and 29·8 per cent. of the 500 dead-hearts examined each week during transplanting still contained larvæ during the *Dalwa* crop transplanting season, during the *Sarva* crop 33·6 per cent., 37·5 per cent., 20 per cent., 18·2 per cent., and 18·3 per cent. It does not follow that the remainder of the seedlings had all been damaged by *Schœnobius* and the moths had emerged. Had that been the case, far more pupæ would have been found. It does however give some indication that quite a high percentage of potential moths are destroyed by the process of seedling selection. 50–70 per cent. of the dead-hearts examined at about the time of harvest for both crops contained larvæ so that by close cutting a number of these must have been destroyed by being dried up in the cut stalks. Left in long stubble in damp fields, they would develop into moths and be ready to infect the succeeding crop.

The larval life is about 3 weeks to a month. The following are a series of observations made in August and September 1920. Egg-masses were collected from the field and hatched on 8th August, 1920. The young larvæ were put out to pot-grown paddy plants and these plants were pulled up at intervals.

TABLE VIII.

Date	Length of larvæ
	mm.
2–IX–20	8
10–IX–20	10
14–IX–20	15
22–IX–20	18
20–IX–20	20
27–IX–20	20

The + 10 mm. larvæ in the above table were then about a fortnight old. In plants which have set their ear-heads and one attacked by *Schœnobius* the larvæ are found either at the last internode or the one just below it. This further strengthens the case for close cutting. When young plants are attacked the larva is found near the root.

VIII. Experiments with coloured lights.

Some experiments were made with coloured lights to see whether *Schœnobius* preferred any colour to the ordinary white light. The lamp globes were covered with coloured paper. The results were negative and are given below for what they are worth.

TABLE IX.

		♂	♀
7-VIII-20	Plain ..	..	4
	Red ..	nil	..
	Green ..	nil	..
0-VIII-20	Plain ..	6	10
	Red ..	..	1
	Green ..	..	1
12-VIII-20	Plain ..	50	12
	Red ..	8	..
	Green ..	2	..
13-VIII-20	Plain ..	8	12
	Red ..	33	8
	Green ..	7	5
15-VIII-20	No catches at any light.		

Further research is needed on the following points apart from checking all the work at Podalada.

(1) Wild food-plants of *Schœnobius*.

(2) Degree of parasitism.

(3) Possibility of immune varieties of paddy.

(4) Extent to which the stubble helps the insect to tide over the time between the crops.

IX. Conclusions.

(1) The method of selecting attacked seedlings at the time of transplanting gives some hope of constituting an effectual control of *Schœnobius*.

(2) Close cutting used in combination with seedling selection should also destroy a large proportion of the larvæ from which the succeeding crop could be infected.

(3) Burning stubble was not found to be practicable but should be tried again.

(4) Figures are given showing (1) infestation in plots selected for estimation of attack in whole area for different seasons. (2) Number of broods of *Schœnobius* in the year. (3) Proportion of spent to gravid moths caught.

(5) It is very doubtful whether light traps would be of much use as a control for *Schœnobius*. Results of a few experiments with coloured lights were negative.

Literature consulted.

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"Proceedings of the III Entomological Meeting," Pusa, 1919.

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"Outline of the Administration in controlling insects and Fungi injurious to Agricultural plants in Japan." Bureau of Agriculture, Tokyo, 1913.

NOTE ON IDENTIFICATION OF SIGA INCERTELLUS, WLK.

The moth dealt with by Mr. Ballard in this paper is one of those unfortunate insects to which so many names have been applied that it is difficult, without extensive incursions into literature, to ascertain its correct synonymy. Owing to the differing appearance of the two sexes and to the wide distribution of the species, a double set ot names has been bestowed on the male and on the female.

The earliest name appears to be *incertellus* (originally published as *incertulas* by error of MS. or printing, but corrected to *incertellus* in the Index) under which name Francis Walker described the male from Sarawak in April 1863, and at the same time, but on a later page of the same volume, he also described the same sex from Ceylon under the name *admotella*. In July of the same year, but later than Walker's Catalogue Vol. XXVII which was issued on 18th April 1863, appeared Zeller's Monograph of the Chilonidæ and Crambidæ in which (p. 4) the female was described from near Calcutta and from Java under the name *Schœnobius punctellus* and the male (pp. 5–6) from the same localities under the name *S. minutellus*. Later in the same year (but after 19th October 1863, the date ot its Preface) was published Vol. XXVIII of Walker's Catalogue, in which (p. 523) this author described the female from Sarawak under the name *Tipanœa bipunctifera*. Yet another name was added by the same author in 1864, in Vol. XXX of the Catalogue, when Walker again described (pp. 967–968) the female from Borneo, China, and Colombo, under the name *Chilo gratiosellus*. Within two years therefore this species received no less than six names.

Considering that this moth is one of the commonest of insects in Southern India and is attracted to light freely, it is remarkable that it does not appear to have been named before Walker's time. In the last three decades of the eighteenth century several hundreds of insects from Southern India were described by J. C. Fabricius in various publications and in this connection I have been over the descriptions of Pyralidæ contained in his *Entomologia Systematica* (1794, 1798) without being able to find any description which can be applied with certainty to this species. It is quite likely that some name, anterior to Walker's, will turn up, but until then we must use *incertellus* as the specific name.

The generic name of this insect has also undergone several changes. For many years the name used has been *Schœnobius*, but recently Sir George Hampson (*A. M. N. H.* (9) IV, 307 ; 1919) has stated that this is ante-dated

by *Siga*, which was described by Hübner in his *Verzeichniss bekannte Schmetterlinge* (p. 197 ; 1822) for *liris*, Cramer, 63 F. and 262 E. Cramer's work is not accessible here and I am unable to trace *liris* further ; it is presumably an exotic species, as it is not included in Staudinger-Rebel's Catalogue of Palæarctic Lepidoptera (1901). The names *Catagela*, *Panalipa* and *Microschœnis* are also synonymous with *Siga* and *Schœnobius*.

The principal synonyms and references for this insect are as follows :—

SIGA, HÜBNER (1822).

Siga, Hb., Verz., p. 197 (1822). Type : *liris*, Cram. Hmpsn., A. M. N. H. (9) IV, 307 (1919).

Schœnobius, Dup., Cat. Lep. Eur. p. 312 (1844). Type : *gigantellus*, Schiff. [Europe.] Hmpsn., F. I. Moths IV, 47 (1896).

Catagela, Wlk., Cat. XXVII, 191 (1863). Type : *adjurella*, Wlk. [Ceylon.]

Panalipa, Moore, Lep. Ceylon III, 386-387 (1886). Type : *immeritalis*, Wlk [Oriental Region.]

Microschœnis, Meyr., T. E. S. 1887, 270 (September 1887). Type : *immeritalis*, Wlk.

INCERTELLUS, WALKER (1863).

Chilo incertulas [laps. cal. aut typogr. pro *incertello*], Wlk., Cat. XXVII, 143 (April 1863). ♂ [Sarawak.]

Catagela ? admotella, Wlk., Cat. XXVII, 192, (April 1863). ♂ [Ceylon.]

Schœnobius punctellus, Zell., Mon. Chil. Cramb. p. 4 (July 1863). ♀ [near Calcutta ; Java.]

Schœnobius minutellus, Zell., Mon. Chil. Cramb. pp. 5-6 (July 1863). ♂ [near Calcutta ; Java.]

Tipanœa bipunctifera, Wlk., Cat. XXVIII, 523 (post September 1863). ♀ [Sarawak.]

Chilo gratiosellus, Wlk., Cat. XXX, 967-968 (1864). ♀ [Borneo ; China ; Colombo.]

Schœnobius bipunctifera, Moore, Lep. Ceylon III, 385, t. 184 f. 13 (1886). ♀ [Ceylon.]

Catagela admotella, Moore, Lep. Ceylon III, 386 (1886). ♂ [Ceylon.]

Schœnobius bipunctiferus, Hmpsn., P. Z. S. 1895, 915, f. 19. (December 1895). ♀ [Oriental Region.]

Schœnobius incertulas, Hmpsn., P. Z. S. 1895, 916. (December 1895). ♂ [Oriental Region.]

Schœnobius bipunctifer, Hmpsn., F. I. Moths, IV, 48, f. 32 (1896). ♀ [China ; Formosa ; throughout India ; Ceylon ; Burma ; Sumatra ; Java ; Borneo.]

Schœnobius incertellus, Hmpsn., F. I. Moths, IV, 48-49, (1896). ♂ [Nagas ; Calcutta ; Ceylon ; Rangoon ; Java ; Borneo.]

Schœnobius bipunctifer, Hering, Stett. Ent. Zeit. LXIV, 74-75 (1903). [Synonymy.]

Schœnobius bipunctifer, Lefroy, Ind. Ins. Life, p. 512 (1909).

,, ,, Poulton, Proc. Ent. Soc. Lond. 1909 38-39, (1909). [Captured at sea.]

Schœnobius incertulas, Poulton, Proc. Ent. Soc. Lond. 1909, 38-39. [Captured at sea.]

Schœnobius bipunctifer, Shiraki, Ins. Pests Formosa, t. 5 (1910 ?). [Life-history figured.]

Schœnobius bipunctifer, Fletcher, S. Ind. Ins., pp. 426-427, t. 29, (1914). [Very serious pest of rice throughout S. India. Life-history figured.]

Schœnobius incertellus, Shiraki, Paddy Borer. [Taihoku Agric. Expt. Stn. Pbln.] (1917). [Important Monograph.]

Schœnobius bipunctifer, Fletcher a. o., Proc. Second Entl. Meeting, pp. 171-174 (December 1917). [Distribution ; damage ; control.]

Schœnobius bipunctifer, Fletcher, Ann. Rept. Impl. Entom. 1917-18, pp. 86-87 (1918).

Schœnobius bipunctifer, Strand, Stett. Ent. Zeit. LXXIX, 262-263 (1919). [Formosa.]

Schœnobius bipunctifer, Fletcher, Ann. Rept. Impl. Entom. 1918-19, p. 88 (1919).

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Schœnobius bipunctifer, Fletcher, Ann. Rept. Impl. Entom. 1919-20, pp. 69-71 (1920).

Schœnobius bipunctifer, Fletcher, Proc. Third Entl. Meeting, I , 121 (November 1920).

Schœnobius bipunctifer, Shroff, Proc. Third Entl. Meeting, I, 342 (November 1920).

Schœnobius bipunctifer, Fletcher and Ghosh, Proc. Third Entl. Meeting, I, 383, 410, t. 42 f. 3, t. 43, (November 1920).

Schœnobius bipunctifer, Ballard, Proc. Fourth Entl. Meeting, p. 22-23, 146 (December 1921).

Schœnobius bipunctifer, Ramakrishna Ayyar, Proc. Fourth Entl. Meeting, pp. 35-36, 52 (December 1921).

Schœnobius bipunctifer, Ghosh, Proc. Fourth Entl. Meeting, pp. 134, 135 (December 1921).

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NOTES ON INDIAN MUSCIDÆ.

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1. NOTES ON THE MUSCIDÆ TESTACEÆ OF THE ORIENTAL REGION.

Shortly after my "Muscidæ Testaceæ of the Oriental Region[1]" had gone to press I received three small collections in this Group, which form the subject of the present paper. These have been sent me by the Imperial Entomologist (60 specimens), the Director, Zoological Survey of India (10 specimens), and the Royal Hungarian Museum, Buda-Pesth, *per* Major Patton of Edinburgh University (8 specimens), this last being part of the collections made in the East by Biro during the years 1898 to 1902, concerning which numerous papers by various authors have appeared from time to time. My thanks are due to Mr. Bainbrigge Fletcher, Dr. Annandale and Professor Kertész[2] for the opportunity they have afforded me of adding to our knowledge in this Group.

BENGALIA.

Bengalia jejuna, F. In the Pusa collection there are the following specimens. Pusa, 1 ♂ 5 ♀, between 30th May and 4th August of various years; 1 ♀, Burdwan, 1st August 1908; 3 ♂ 6 ♀, Chapra, no dates (*Mackenzie*); 1 ♂, Poona, 7th to 9th September 1919 (*Austin*); a ♀, labelled in Howlett's writing '11th September 1906,' is presumably from Allahabad, where Howlett was stationed at that time; whilst there is a ♂, without locality, labelled 'on cattle.' The Calcutta collection contains a single ♂ from Jabalpur, June-July 1922 (*Ribeiro*).

Bengalia jejuna var. *quadrinotata*, Big. This variety is evidently more common in North Bihar than is the typical form, though one or two specimens show intergrading in leg coloration. In the Pusa collection are 10 ♂ 9 ♀ from Pusa, between 12th June and September of various years; a pair from Chapra, no dates (*Mackenzie*); and a ♂, Paraiya, 9th August 1910, 'on pony,' (*D. M.*) It is not represented in the other collections. It will be recollected that the

[1] Senior-White, *Spolia Zeylanica*, Vol. xii, part 46, pp. 294–314.

[2] I regret to add that information has since been received of the death of Professor Kertész at the end of 1922.

specimens from which I redescribed it in my earlier paper[1] are from Banhar, in North Bihar, whilst the specimen seen by Bezzi and referred to in his paper of 1913[2] was from Calcutta.

Bengalia lateralis, Macq. In the Pusa collection are a ♀ from Pusa, 13th June 1920 (*Austin*); a ♂ from Purulia, 5th August 1908; a ♂ from Hoshiapur, 14th July 1909; a ♂ from Coimbatore, 12th December 1921 (*Fletcher*); and a ♀, no date, from Kala Dongi Road, Naini Tal. In the Calcutta collection are a ♂ from Chilka Lake, 'at edge on mainland near culvert 901,' 2nd November 1922; a ♀ from Trichur (Cochin), 1st to 4th October 1914 (*Gravely*); and 2 ♂ ♂ from Masuri and Coorg (*Hannyngton*), both without dates.

The collections of these three species present several points of interest. In the first place, in all of them the strength of the abdominal banding is the reverse of that laid down in my earlier paper, being almost absent in *jejuna* and its variety and very strong in *lateralis*. This being the exact opposite of my findings on Ceylon specimens, it can only be decided that separation based on this character is impossible, and females can only be correctly placed if males from the same locality, which can be at once distinguished on the fore tibial armature, are available for decision as to the type of banding obtaining in that locality. The determination of unrelated females in the foregoing distribution is in some doubt, therefore. Secondly, it will be noticed that North Indian specimens, with a single exception, have been taken entirely during the S. W. monsoon months, whilst those from South India, like the Ceylon specimens, date, with a single exception also, during the N. E. monsoon months. Now in the north this latter is almost non-existent, being represented, if at all, by the weak *Hathia* rains of October, and it may therefore be said that these species emerge and are on the wing only during the period of maximum rainfall in any locality*. Thirdly, two references, one to *jejuna* and the other to var. *quadrinotata*, refer to capture on animals. I have also received a specimen of the former from the Government Veterinary Surgeon, Ceylon, taken by his Assistant in Kandy as a 'cattle fly.' As Cragg[3] has shown, there is no trace of a biting apparatus in the otherwise remarkable proboscis, and it therefore becomes of interest to discover why these flies are, on occasion, taken on animals. Further observations on this point are required.

[1] Senior-White, *Spolia Zeylanica*, Vol. xii, part 46, pp. 294–314 (1923).

[2] Bezzi *Entomologische Mitteilungen*, ii, 75.

[3] Cragg *Indian Journal of Medical Research*, v. 516.

* [Since this memoir was sent to press, I have found a species of *Bengalia* on the wing at BhimTal in April 1923, during the dry weather.—T. B. F.]

Bengalia escheri, Bezzi. The Calcutta collection contains a single male from above Tura, 3,500—3,900 feet (Garo Hills, Assam), between 15th July and 30th August 1917 (*Kemp*), which agrees exactly with Bezzi's description of this species, which was described from Formosa. The following points are worthy of mention:—the femoral rings are not very distinct, and the hairs on the hind tibiæ are really only pubescence and hardly noteworthy, being much less prominent than those on the hind femora. The mid femoral serration, on which Bezzi lays stress, is merely the 'kamm' (*apud* Böttcher), present in varying degrees in all the species, in this case strongly developed and very closely set as to individual bristles.

Bezzi's "Group II" in the genus now becomes Indian as well as Far Eastern, but if my key to the Indian species be employed, the species will run out in couplet 2 and there separate on the vibrissal insertion being close to, instead of far above, the epistomal margin, on the darkened wings and prominent black facial fleck. This specimen is undoubtedly the most interesting discovery of the whole collection.

Bengalia surcoufi, White. Two females, Shillong, September 1920 (*Fletcher*), and Matheran, 8th July 1902 (*Biro*), are probably this species, but again I hesitate to distinguish definitely in the female sex between this species and my *bezzi*, as separation rests only on colour. *B. surcoufi* being a Himalayan species its occurrence in the Khasis is not surprising, and it is probably the *Bengalia* seen, and lost, by myself at Shillong the following month.[1] This was certainly not *B. escheri*, which must occur in the Khasis as well as the Garos, as the latter is so distinct a species that I should certainly have recognized my lost specimen in it when I saw Dr. Kemp's capture, had they been the same species.

Bengalia bezzii, White. In the Pusa collection a ♂ from Pusa, 18th August 1905; 3 ♂ from Chapra, no dates (*Mackenzie*); a ♂ from Dumraon, 15th September 1906 (*Chatterjee*); and two ♂ without data.

Bengalia varicolor, F. In the Calcutta collection a ♀ from mile 10—14, Cochin Forest Tramway, 25th and 28th September 1914 (*Gravely*), is almost certainly this species. I still await the discovery of a ♂ indubitably of this species to discover whether or Meijere's *latro* is valid or merely a colour variety of the Fabrician species.

Bengalia latro, Meij. In the Calcutta collection 1 ♂ 2 ♀ from Parambikulam (Cochin), 16th to 24th September 1914 (*Gravely*). Apparently this Javanese species is entirely confined in our region to the Ceylonese Province, and is on the wing there just before the arrival of the N. E. monsoon.

[1] Senior-White *Memoirs Agric.* (*Entom. Series*), VII, 100.

CAIUSA.

Caiusa testacea, White. The Biro collection contains an absolutely typical ♀ from Singapore, 1898.

The same collection has yielded the unique type of the following new species in this genus.

Caiusa nigronitens, sp. nov.

Female. *Head:* frons one-fifth of head width viewed from in front; frontal stripe brown, darkened laterally; parafrontalia dark silvery-grey. Face, parafacialia and cheeks silvery. Antennæ, second joint testaceous, third dark greyish; arista pale dirty brownish. Epistomal margin pale dull yellowish. Proboscis black, palpi yellow. About ten interior frontals, two exterior, of which the lower is the strongest. *Thorax:* disc shining black with hints of bluish posteriorly, some short white pollen anteriorly. Humeri yellow, pleura dark pollinose greyish, both spiracular areas yellow. Scutellum concolorous with mesonotum. *Chætotaxy:* Acrostichals 1 : 1 (presutural weak); Dorso-centrals 2—4; Humerals 3; Notopleurals 2; Presuturals 3; Anterior supra-alars 2 : 1; Postalars 2; Mesopleural fan of 6; Pteropleurals 3, small, in a bunch, but strong; Sternopleurals 1 : 1; Hypopleurals 6, in angled row scutellars, an apical, subapical and 2 marginal pairs. *Abdomen:* first apparent segment, except hind margin, pale yellow, remainder, and other segments, all shining black with a tinge of bluish. Venter yellow. *Legs:* Coxæ, fore and hind femora pale yellow, mid femora and all tibiæ and tarsi rather darker brownish. *Wings:* clear, veins yellowish, costal spine weak, third vein spinulose above and below one-third of distance to small cross-vein. Halteres and squamæ pale yellowish.

Long 7 mm.

Described from a unique female in good condition, Singapore, 20th to 26th January 1902 (*Biro.*). In the Royal Hungarian Museum, Buda-Pesth.

PARATRICYCLEA.

The following new species I place, with some doubt, in the above African genus, which thus becomes extended to the Orient also. If my generic location is correct, Matheran on the Western Ghats is exactly the place where one would expect to find in Asia an outlier of the African fauna.

Paratricyclea asiatica, sp. nov.

Male, female. *Head:* male eyes closely approximated, frontalia reduced above to a line, below forming an elongate triangle, castaneous, lightly striated

longitudinally ; parafrontalia dull silvery grey, the whole frons on its lower half elevated above the eyes, seen in profile. Ocellar triangle black, with brilliant yellow ocelli. About nine interior frontals. Female ; frontal width greatly exceeding that of an eye, nearly equalling both of these together, frontal stripe and ocellar triangle as in male, parafacialia rather more darkened. Exterior frontals two, rather weak, interior frontals strong, commencing at level of lowest interior frontal, though there may be an unpaired irregular one or so above this, (generic character). Lunule prominent, pale silvery. Face reddish, silvery pollinose, with very strong median carina, antennal ridges more golden, with only about three weak bristles above the vibrissæ, para-facialia dull pale golden-silvery, quite bare. Genæ concolorous below, laterally slaty-grey, but anteriorly with a big pinkish-brown patch, which is almost without pollen, sub-ocularly with numerous fairly long, fine hairs. Peristomal row of about nine strong bristles. Antennæ first two and base of third joint orange, remainder of latter dull silvery-grey, its length about three times that of second joint, first joint small ; arista yellow, except the thickened base of the second joint, black, plumose to tip above, but with only about six rays in the middle below. Palpi yellow, not clavate apically. Occiput dark. *Thorax :* dorsum dark grey with four irregular, blackish ill-defined stripes, pleuræ concolorous, the sutures yellow-brown ; scutellum dull yellow-brown, the whole with grey pollen. *Chætotaxy :* Acrostichals 1 : 1 (the presutural may be absent and there may be a second post-sutural). Dorso-centrals 2 : 3 ; Presuturals 3 ; Humerals 2 ; Notopleurals 2 (anterior may be wanting) ; Pre-alars 2 ; Intra-alars 2 ; Post-alars 2 ; Mesopleurals 5 ; Sterno-pleurals 2 : 1 ; Hypopleurals 8, in angled row ; Ptero-pleuron with bunch of weak bristly hairs. *Abdomen* as long as head and thorax together, greyish with some yellow pollen and with black flecks, most apparent at posterior angles of the segments ; traces of a median black vitta. Apparent segments 2 to 4 with marginal bristles, on first of these only laterally. Sternites exposed. *Legs* yellow, tarsi blackened ; the submeso-tibial bristle on the interior face of the mid legs absent in the male. *Wings* clear, tinged yellow on fore margin, costal spine present, fairly strong ; third vein with only two or three weak bristles on basal node above and below, practically absent in male. Squamæ yellow.

Long 7-8 mm.

Described from 1 ♂ and 3 ♀, the former in good, the latter in fair condition, Matheran, 8th July 1902 (*Biro*). Type male, allotype and co-type females, in Royal Hungarian Museum, Buda-Pesth, co-type female in my own collection.

The bristly area of the facial ridges is so weak that the species might almost equally fall into de Surcouf's 'Group II' and run to the Far Eastern genus *Phumesia*, but against this is the very wide front and the almost non-bristly third vein.

In the collection of the Colombo Museum is a female specimen, in bad order, of an undescribed species, taken at Nuwara Eliya (Ceylon Montane Zone), which would also run out at *Paratricyclea*. It is, however, obviously not congeneric with the foregoing species, and has the dark, bristly appearance of a Tachinid. Until further specimens in good condition come to hand, I refrain from describing it, merely mentioning its existence here to indicate that the muster of the Oriental species of this Group is still far from complete.

2. NOTES ON INDIAN RHINIINÆ.

Since Townsend's[1] paper of 1917 no further information on the flies of this sub-family has been published, save a few descriptions of new species by myself. Having recently determined the collection, amounting to 285 specimens, accumulated since the inception of the Agricultural Research Institute, Pusa, in the laboratories of the Imperial Entomologist, as well as a few additional specimens sent me by the Director, Zoological Survey of India, and 19 specimens from the Royal Hungarian Museum, Buda-Pesth, collected by Biro, the following notes on the various species are offered. Some additional information has been drawn from my own collection in this group which amounts to over 200 specimens representing thirty species.

Whilst once again expressing my indebtedness to the Curators of these various collections for placing them at my disposal for study, I would express my especial thanks to Dr. Annandale of the Zoological Survey for loaning me for study certain specimens determined by Townsend, without which the elucidation of the species concerned would have been well-nigh impossible, owing to insufficient description. Only the sight of the actual specimens has prevented my falling into a serious error, which clearly proves how advantageous it is that specimens are not for ever immured within the walls of the Indian Museum, as is the case with the British Museum. Had Townsend's types been deposited at South Kensington instead of at Calcutta, growth of our knowledge of the Indian species would have been hampered for years to come.

I have given to specimens the names accorded to their species by Townsend and have described as new such species as do not appear in his

[1] Townsend. *Records of the Indian Museum*, xiii, 185.

paper, but it is necessary to point out that the literature of the sub-family contains a mass of descriptions by Desvoidy, Macquart, Walker and Bigot which are, of themselves, unrecognizable, and necessitate type-elucidation. When this has been undertaken by the writer during his next leave to Europe, workers must be prepared for a large amount of fresh synonymy in which doubtless, many of Townsend's and my own names will be sunk in favour of those of earlier authors. It is impossible to imagine that many of the large, conspicuous, and fairly common species which both of us have described as new have escaped all description prior to 1917.

BORBORORHINIA.

Borbororhinia pubescens, Taxd. 6 ♂ 1 ♀, Santikoppa (N. Coorg), 4th to 10th May 1914, 'attracted to opened *Eutermes* nest' (*Fletcher*); 2 ♂, Anamalais, 4,000 feet, 23rd January 1912, 'flying round exposed comb of *Eutermes*' (*Fletcher*).

The species can be obtained in quantity at any time, in my Ceylon experience, by opening the nest of one of the mound-building termites, though otherwise only seen as a great rarity on flowers. Males are chiefly attracted, but amongst them are a few females, which are quickly seized on by the males. They fly readily whilst *in cop.*, but I have managed to confine pairs so taken, and watched developments. The species is oviparous, the eggs white and large for the size of the fly, so their hatching within 24 hours is not surprising, indicating considerable embryonic development *in utero*. I have not been able to get the resulting larvæ to feed, and so have been unable to follow the life-history further. No trace of larger larvæ or puparia has been found among the fungus combs or in the galleries of the termite. After a few hours the exposed comb and fresh-cut earth cease to attract specimens but if a nest be left half-opened one day, and be again cut into the next day, as soon as fresh earth and comb is exposed, specimens again appear in quantity.

COSMINA.

Townsend doubted whether this genus was Oriental at all. As de Surcouf[1] has subsequently shown, the Javanese *Phumosia fulvicornis*, Bigot, really belongs to it, whilst I now add thereto the following new North Indian species which is almost certainly a true *Cosmina*, veins I and II bearing bristles on the upper surface only, the former basally, the latter on the node only.

[1] Surcouf. *Nouvelles Archives Mus. Hist. Nat., Paris*, (5) vi, 117.

Cosmina indica, sp. nov.

(Plate III, fig. 6.)

Male, female. *Head*: frontal stripe rich brown, parafrontalia and ocellar triangle yellowish grey with black spots. In male frontalia reduced to a line, parafrontals distinct, width of frons over all at narrowest about that of second joint of antenna; in female frontal width at root of antennæ a full third of head width, not greatly narrowed above. Face and parafacialia ashy yellowish, the former shining, the latter often with dark spots on them and on genæ, especially in the male. Vibrissæ considerably above mouth border. Antennæ fulvous, third joint grey dusted, arista with yellow shaft, broadly plumose to two-thirds its length. Palpi luteous, spatulate. Occiput black, postocular margin pale greyish. *Thorax:* dorsum dully greenish-cupreous, almost hidden beneath whitish pollen, the whole thickly stippled with black dots. A pair of black dorso-central stripes, indistinct and more or less interrupted at and exteriorly displaced behind suture. Scutellum more shining green. Pleura as dorsum. *Chætotaxy:* Acrostichals 0 : 2; Dorsocentrals 2 : 4; Pteropleural strong; Sternopleurals 1 : 1; Scutellars 6, apicals crossed. *Abdomen* purplish cupreous, greyish pollinose, black stippled, with an obscure black median vitta. Irregular discals on apparent fourth segment. *Legs*: femora black, tinged metallic green; tibiæ yellowish brown, tips black; tarsi variable, yellowish brown to black. *Wings:* greyish, infuscated along fore margin, especially apically. Squamæ pale yellowish. Long 5-6·5 mm.

Described from 22 specimens, all in good to fair condition, taken at Allahabad, Lucknow, Chapra, Banhar, on various dates. Type male from Allahabad, 16th March 1906 (*Howlett*) and allotype from Banhar, 2nd August 1921 (*Inglis*). In my own and the Pusa collections. A greasy female from Lyallpur, 24th July 1917 (*Dutt*), also appears to be this species, which I cannot identify with any of the published descriptions of Walker and Bigot.

SYNAMPHONEURA.

Synamphoneura cuprina, Big. In the Pusa collection a ♂, 9th March 1915; a ♀, 5th May 1911, both from Pusa; 1 ♂ 4 ♀, Chapra, no date (*Mackenzie*); a ♂, Mercara (Coorg), 15th to 20th October 1915 (*Fletcher*); a ♀, Gudalur (Nilgiris, 3,000 feet), 19th September 1917; and a ♀, Lashio (Upper Burma), 6th October 1918. Two males from Kuala Lumpur (F. M. S.), no date, in Biro collection.

All the foregoing specimens, as well as a small series of both sexes from Banhar in my own collection sent me by Mr. H. A. Inglis, have the first

posterior cell open, whereas Townsend states that it is closed in the margin or extremely short petiolate. Specimens with the cell open would run to *Cosmina* by his key, and superficially the species is very like *C. indica*, described above, but can at once be distinguished by the shining black face which is lacking in the latter. The elucidation of these aberrant specimens was rendered possible by two specimens from Gauhati, in my own collection, in which the cell is closed. Examination of the male genitalia proved the two forms to be conspecific (Plate III, fig. 5).

IDIELLIOPSIS

Idielliopsis similis, Tnsd. In Pusa collection 3 ♀, March-April of various years, from Pusa; 3 ♂ 6 ♀, Chapra, no date (*Mackenzie*); a ♂, Coimbatore, March 1910; a ♀, Simla, May 1918 (*Fletcher*); and a ♂ from Maymyo (Upper Burma, 3,500 feet), 19th to 21st August 1914 (*Fletcher*). In the Biro collection a ♀ from Kuala Lumpur, without date. Dover [1] has recently recorded this species from Barkuda Island, Chilka Lake, Orissa.

RHINIA

Rhinia testacea, R. D. In Pusa collection a ♀, Kurseong, 7th to 20th June 1922 (*Fletcher*), and a ♀, Lower Lebong, 2nd to 9th June 1909 (*Howlett*), are the first Sikkim records for the species. A ♂, Bombay, 6th August 1918 (*Fletcher*), and a ♀, Sojitra (Baroda) (*Patel*). A ♀ from the Khasis, 1,000—3,000 feet, 20th May 1905, is another instance of a widely distributed species being found there and in Ceylon, not recorded by myself. The exact locality is uncertain; the damaged label appears to read 'Dumpep,' but this is impossible if the elevation is correctly stated. In the Biro collection a pair from Bombay, 27th March 1902.

Villeneuve[2] has recently stated that this species is merely a variety of *R. apicalis*, W., but for the present I retain the species as distinct, and give herewith a figure of the Oriental species' genitalia, for comparison with the African by those who have access to the latter (Plate IV, fig. 9).

STOMORHINA

Stomorhina lunata, F. In Pusa collection 3 ♂ 1 ♀, Bostan, Baluchistan "from locusts' eggs, June 1915 (*ex* Quetta Museum)." If this species is really a parasite of locusts in the egg stage, further study of its habits is certainly necessitated.

[1] Dover. *Records of the Indian Museum*, xxii, 396.

[2] Villeneuve. *Trans. Entomological Soc., Lond.*, (1921), 523.

IDIELLA.

Idiella mandarina, W. In Pusa collection: 5 ♂ 2 ♀, Pusa, in February to April of various years: 6 ♂ 2 ♀, Chapra, no date (*Mackenzie*): 2 ♂, 1 ♀, Allahabad, April, September, November, 1905-06 (*Howlett*): a ♂, Sojitra (Baroda), March 1915 (*Patel*): a ♀, Nagpur, March 1906; a ♂, Dadar, Bombay, 21st March 1905 (*Patel*): a ♀, Yercaud (Shevaroys, 4,500 feet), 17th to 21st December 1913 (*Fletcher*): 2 ♂, Cherambadi (Wynaad), October 1913 (*Howlett*); a ♀, Darjiling, August 1908 (*Middleton*). Appears to be mainly a Spring species in the Plains.

EUIDIELLA.

Euidiella discolor, F. In Pusa collection: 23 ♂, 26 ♀, Pusa, in all months of various years except April, June and July: 18 ♂ 9 ♀, Chapra, no date (*Mackenzie*); Allahabad, ♂, 5th October 1905, ♀, 13th November 1905 (*Howlett*): 2 ♂, Igatpuri, 9th October 1913; ♂, Bombay, 13th August 1904 (*I. R.*): labelled 'parasite on cattle' (*sic !*): ♂, Belgaum, 7th August 1910 (*Fletcher*); 2 ♂ 1 ♀, Telinkheri, Nagpur, 10th October 1911 "from white ants' nest"; a pair from Belgatchia (nr. Calcutta), 15th November 1906 (*Patel*); ♀ Bankipur, 25th October 1911 (*Fletcher*): ♀, Sidapur (Coorg), 13th and 14th May 1914 (*Fletcher*); 3 ♂, Abbottabad, 21st May 1915 (*Fletcher*); 1 ♂, 2 ♀, Kurseong, 7th to 20th June 1922 (*Fletcher*). In Calcutta collection is a ♀ from Ukhrul (Manipur, 6,400 feet), no date (*Pettigrew*).

The foregoing details contain one reference to termitophily. I have succeeded in rearing the species from larvæ found in an ants' nest,* (*Camponotus angusticollis*, Jerd.), found around the diseased roots of a rubber-tree on 7th April 1921. The tree was affected with *Botryodiplodia theobromæ*, and, the lactiferous system being dried up, was riddled with small boring beetles. The ants' nest, or rather the larvæ and pupæ, for there was no true nest, was among loose pebbly soil between the roots. In opening up *Barbarorhinia pubescens* were attracted in numbers, also a single specimen of *Eu. discolor*, with a male *Musca ventrosa*, W., and a Tachinid. Amongst the earth were found two Muscoid larvæ, yellow-brown in colour, the posterior end with a crown of fleshy tubercles, not unlike these of a *Sarcophaga* if these were permanently everted. The pharyngeal skeleton was large for the larva, and heavily chitinized. They were strongly negatively heliotropic. Placed in some of the earth with larvæ and pupæ of the ant, 2 males and a female of *discolor* emerged on 18th and 19th of the month. The puparia were smooth,

* Determined by Mr. G. R. Dutt.

brown-red, with traces of the posterior processes of the larvæ. Only shrivelled vestiges of the ant material remained, appearing as if the larvæ had fed upon them. I have never succeeded in obtaining the early stages of the species again, though it is far the commonest Rhiniine Muscid in the East, and its life-history must be "about six feet away," as Farquharson phrased it.

Euidiella quadrinotata, Big. A ♀, without locality, bears a label in Howlett's writing "*Idia*, 8—9, unnamed in B. M."

Euidiella purpurea, Tnsd. In Pusa collection 4 ♂, 7 ♀, Buxar Duars, May 1907 (*Nowroji*); 5 ♂, Sidapur, March to May of various years (*Fletcher and Y. Rao*); ♂, Simla, October, 1908 (*Howlett*).

Euidiella nila, White. 17 ♂, 6 ♀, Kodaikanal, 7,000 feet, August to October 1921 (*Fletcher*). Originally described from the Nilgiris, this species seems to be confined to the Hill districts of the South of the Peninsula.

The Pusa collection contains a small series of the following new species :—

Euidiella termitophila, sp. nov.

Female. *Head:* frons about $\frac{1}{3}$ of head width; frontal stripe black, parafrontalia silvery, nearly obscured by black spots; parafacialia similar, face shining black. Antennæ dark brown, third joint thickly grey-dusted. Genæ grey with long pale pubescence. Palpi dark brownish. *Thorax*: obscurely metallic blue with black hair-bearing spots. Pleura similar, sternopleuron grey pollinose. A few conspicuous pale hairs on hinder margin of mesopleuron and on pteropleuron. *Abdomen*: basally yellow, probably completely so, if unstained. In all the specimens before me a varying extent posteriorly appears black, often one side or another of the apparent second and third segments is so coloured, leaving the other yellow; in all cases the apparent fourth appears darkened. *Legs*: yellow, tips of hind femora darkened. *Wings*: clear, veins yellow, halteres yellow, squamæ yellowish-white. Long 4·5 - 5 mm.

Described from 9 ♀, none in quite perfect enough condition to make the ultimate type, all paratypes, taken at Lashio (Upper Burma, 3,000 feet), on 23rd and 24th August 1914 (*Fletcher*); "attracted to opened *Eutermes* nest." In the Pusa and my own collections.

Euidiella unicolor, Tnsd. Townsend gives only a differential description of this species, but, thanks to the loan of one of his specimens by Dr. Annandale, I am able to draw attention to the omission of all mention of an apical infuscation of the wing, (though this probably varies in depth in individuals), and

can now offer the following table for the discrimination of the Oriental species of the genus :—

1. Femora always black (base of hind pair sometimes paler).....2
   Femora pale brownish-yellow.....*termitophila*, sp. n.
2. Front tibiæ pale, at least basally.....3
   Front tibiæ all black.....6
3. Abdomen all dark, without trace of yellow markings.....4
   Abdomen with some yellow markings.....5
4. Large species, thorax green, abdomen purple.....*purpurea*, Tnsd.
   Small species, abdomen dark green.....*unicolor*, Tnsd.
5. Abdomen luteous, with black median stripe of varying extent.... *discolor*, F.
   Abdomen black, with brown spots on 2nd and 3rd segments.... *quadrinotata*, Big.
6. Genæ and pleural stripe yellow.....*discolor* var. *nigripes*, White.
   Genæ and pleural stripe grey.....*nila*, White.

METALLEA

Metallea flavibasis, White. A ♀, Allahabad, 16th October 1905 (*Howlett*).

Thanks to the discovery in the Pusa collections of indubitably related females, I am able to undertake the description of a species hitherto known to me only from a few males, which I had hesitated to describe before lest these males prove only those of my *flavibasis*. of which the male is still unknown.

Metallea nigrofemorata, sp. nov.

Male, female. *Head:* male subholoptic ; female, frons one-third of head width. Frons and face shining yellowish, in female ocellar area, parafrontalia and upper part of parafacialia silvery-yellow pollinose, much paler than the remainder, genæ concolorous, with pale hairs. Antennæ yellowish-brown, second joint brighter than the third, arista only microscopically pubescent. Palpi yellow, narrowly ligulate-clavate. *Thorax*: brownish, tinged with green or purplish, the green more distinct on the scutellum, the whole silvery pollinose. Pleura similar, but more silvery dusted. *Abdomen:* first three apparent segments yellow, with an obscure median dark vitta, fourth segment metallic purplish in certain lights, in others dark, with some white pollen. Discals lateral except on apparent fourth where they occur, irregularly, medianly, especially in the female, where they are noticeable amongst the regular hemi-macrochætal vestiture. *Legs*: black, all tibiæ and metatarsi yellowish-brown, tips of former blackened. Femora with more or less grey dusting. *Wings*:

clear to lightly yellowish on fore margin, squamæ pale yellowish. Long 6·5–8 mm.

Described from 2 ♂, Suduganga, Matale, Ceylon; 3 ♂, Kurseong (Sikkim, 5,000 feet) (*Fletcher*); a ♀, Allahabad, 13th March 1906 (*Howlett*); a pair from Chapra, no date (*Mackenzie*). Type male from Suduganga, 9th November 1918, allotype female, Chapra, in my own collection. Co-types in my own and Pusa collections.

Only distinguished from *M. flavibasis* by the all-black femora, though the general appearance of the thorax is darker; lacks the metallic abdominal patches of *notata*, Wulp.

TRICHOMETALLEA

Trichometallea pollinosa, Tnsd. In Biro collection a ♂ from Trichinopoly, 8th March 1902; 4 ♂ 3 ♀ Dhond, 13th March 1902.

In my opinion the epistome of this species is so far forward-directed that the ordinary worker would locate the species in the first portion of Townsend's key. As regards its affinities, of course, it is correctly placed in the second. This point should be borne in mind when using the generic key given by Townsend.

THORACITES.

Thoracites abdominalis, F. 1 ♂, 2 ♀, Colombo, 28th February 1902 (*Biro*).

CHLOROIDIA.

Chloroidia flavifrons, Tnsd. In Pusa collection 4 ♂, Cherambadi (Wynaad), October 1913 (*Howlett*).

STRONGYLONEURA.

In separating and describing four species in this genus Townsend admitted to considerable doubts, but, after separating four forms corresponding to his four species, I find on dissection that the genitalia show specific differences, and that the species are all valid. All four, however, are very prominent species, and I doubt if any of the Townsend names will ultimately prove valid. The species may be separated on external characters as follows, but in every case I would recommend proof by genitalia examination, where males are concerned, as the external separatory characters are weak.

1. Parafacialia golden to brown 2
   Parafacialia grey ..... *cœrulana*, Tnsd.
2. Green species 3
   Purplish species, or with much white pile ..... *nebulosa*, Tnsd.
3. Facial hairs yellow ..... *nepalana*, Tnsd.
   Facial hairs black ..... *viridana*, Tnsd.

Strongyloneura nepalana, Tnsd. In Pusa collection a ♂, Muliyar (Palnis, 4,000 feet), 11th October 1921 (*Fletcher*); a ♀, Kodaikanal, October 1921 (*Fletcher*); a ♀, Valparai (*Anamalais*), 18th December 1917 (*Y. Rao*); 1 ♂, 3 ♀, Muktesar (Kumaon, 7,500 feet), September 1922 (*Fletcher*). The species is common in Ceylon, and is found also in the Khasis. (Plate II, fig. 1).

Strongyloneura nebulosa, Tnsd. In Pusa collection: 2 ♂, Gauhati, 4th June 1921 (*Mrs. Fletcher*); a ♂, Calcutta, 1st July 1904 (*per* C. V. D., Bengal); a ♀, Haflong (Assam), 27th October 1911 (*Ghosh*); ♀, Cherambadi (Wynaad), October 1913 (*Howlett*); ♀, 1,000—4,000 feet, Darjiling-Himalaya Railway, (Sikkim), 7th June 1922 (*Fletcher.*) Not very common in Ceylon. Apparently a Malayan form. (Plate II, fig. 3).

Strongyloneura viridana, Tnsd. In Pusa collection 24 ♂ 3 ♀, Muktesar (Kumaon, 7,500 feet), September 1922 (*Fletcher*). Found also in the Khasis, this species is apparently confined to the mountains of Northern India. (Plate II, fig. 2).

Strongyloneura cœrulana, Tnsd. In Pusa collection, a ♀ from Kodaikanal, 1st October 1921 (*Fletcher*). Occurs sparsely in Ceylon. Apparently a Malayan form. (Plate III, fig. 4).

IDIOPSIS.

This Mediterranean genus is apparently represented in India by the following new species from the Western Himalaya.

Idiopsis argenticincta, sp. nov.

Male, female. *Head:* male frons reduced to a line; ocellar triangle black, elongate, ocelli amber-color; frons dark brown, parafrontalia below silvery-grey, pinched out above; face shining blackish, epistomal margin dull luteous; parafacialia silvery-grey, with a large dark brown spot in the middle; facial ridges flattened; genæ dark grey, with a large yellowish-brown spot anteriorly, but separated from the yellow of the epistomal margin by the dark grey of the peristomal border; frontal bristles long but fine; vibrissæ arising far above epistomal margin, nearly as high as the tip of antennæ. Antennæ short, the distance from their tip to the epistome being more than their entire length; arista long—pubescent above, only a few short hairs in middle below; upper eye-facets enlarged. Palpi black, barely clavate apically. Female frons exceeding an eye-width, the black parafacial fleck and yellow genal spot not prominent; upper half of parafrontalia shining black, the two together at least as broad as the frontal stripe. Upper eye-facets not enlarged. Two or three proclinate exterior frontals; otherwise as in male. *Thorax:* black

with greyish pollen. A girdle of silvery pollen from sternopleuron, across mesopleuron, dorsally, interior to humeral region, narrowed to posterior half of presutural area, across from side to side. The prescutellar area has some silvery pollen dorsally. *Chætotaxy:* Acrostichals 1 : 1; Dorsocentrals 2 : 3; Humerals 2; Presuturals 2; Notopleurals 2; Alars 2 : 2 : 1; Mesopleurals 4; Sternopleurals 1 : 1; Hypopleural fan strong. *Abdomen* shining black, no discals except on apparent fourth segment. *Legs* black, female tarsi barely widened, claws very strong, more so than in male. *Wings* infuscate along veins and with broad anterior dark stripe; fourth vein suddenly bent at rounded angle, but its last portion turning parallel to third vein, (which runs straight to margin), leaving first posterior cell well open. Anterior cross-vein below tip of first vein, but one specimen has a distinct adventitious cross-vein in both wings below the tip of the subcostal vein. Costal spine practically absent. No bristles on first or third veins. Tegulæ pale. Long 5·5 mm.

Described from one male, Simla, May 1918 (*Fletcher*), type, and two females, Muktesar, September 1922 (*Fletcher*), allotype and co-type, the first two in Pusa, the last in my own collection. The male is greasy, and the thoracic band is not apparent.

The species presents the following points of difference from the generic characterization :—the shorter plumosity of the antennæ and the lesser number of proclinate frontals in the female, but, until the genotype is further examined, it is unnecessary to erect a new genus for its reception on such differences.

METALLIOPSIS.

Metalliopsis setosa, Tnsd. In Pusa collection, a ♀, Kurseong, 7th to 20th June 1922 (*Fletcher*). In Biro collection 4 ♂, Singapore, 1898.

NITELLIA.

I place the following new species in this European genus with some doubt.

Nitellia khasiensis, sp. nov.

Female. *Head:* frons two-fifths of head width, exceeding that of either eye; frontal stripe black, bare, parafrontalia pale cinereous, both together not as wide as frontal stripe. Parafacialia and genæ pale cinereous, former with a touch of golden in a stripe from lower angle of eye to level of second antennal joint, both with sparse short black hairs, but below eye and more broadly along each epistomal margin a bare area, appearing more grey in

colour. Antennæ dark grey pollinose, arista with about eight short rays below. Palpi dark brown, not widened apically. *Thorax* dark grey with ashy pollen, scutellum and pleura similar. Presuturally four black stripes converging anteriorly. *Chætotaxy:* Acrostichals 1: 3; Dorsocentrals 2: 3; Humerals 2; Presuturals 2; Alars 3: 1: 2; Notopleurals 2; Mesopleurals 4-6; Sternopleurals 2 : 1; Scutellars an apical (crossed), preapical and 3 marginal pairs. *Abdomen* grey and black tesselate. *Legs* black. *Wings* clear, slightly yellowed on fore margin. Costal spine present, short. Third vein bristly on node only. First posterior cell very narrowed to petiolate, (in opposite wings of the same specimen). Long 5·5 mm.

Described from four females, Shillong, 4th to 20th October 1920, all in my own collection. This is the species referred to as "*Pollenia sens. lat.*" in my 'Diptera of the Khasia Hills.' Owing to the absence of the mesoscutal flat impression I am uncertain whether this species is correctly located, but, there being no facial carina that I can make out, it cannot fall into *Polleniopsis* with which it seems to have its closest affinity.

POLLENIA.

Pollenia rudis, F. When Townsend wrote this species was not known to be Indian, the Trans-Karakoram locality in Chinese Eastern Turkestan whence he recorded it being strictly Palæarctic. In the Calcutta collection I find 9 ♂, 'between Yangi-Hissar and Sirikol', (Yarkand Exped.), which are evidently part of the same material as the single specimen seen by Townsend, in whose paper 'Sinkol' is obviously a misprint. The reason why these further specimens were not included in the Rhiniine material sent to Townsend is that one of them bears a label in Bigot's handwriting "*Sarcophaga microstoma*, n. sp.," and they reached me among the Museum's collections in that genus, not as Rhiniinæ at all! I cannot find that Bigot ever described his "new species," and the *nomen nudum* can be forgotten. In addition to these specimens the Calcutta Collection contains a male from Jhelum Valley, Kashmir, 5,200 feet, July—September 1916 (*Pease*), which brings this species definitely on to the Indian faunal list. The palpi are yellow not black as in European specimens, but comparison of the genitalia of the specimen with such reveals that the two are conspecific. The palpi of the Pamir specimens are black. (Plate IV, fig. 7).

Receipt of the above-mentioned European specimens of *P. rudis* has enabled me to describe the following new species in the genus, which is so closely allied to *rudis* in appearance that, had not the genitalia proved different I should have hesitated to separate them.

POLLENIA INDICA, sp. nov. (Plate IV, fig. 8).

Male, female. *Head:* male frons about $\frac{1}{8}$ of head width, female greater than a third thereof; frontal stripe black, parafrontalia silvery-grey, in female each wider than the frontal stripe; face, genæ and occiput silvery-grey. Antennæ blackish, tip of second joint rufous, arista with rays shorter than in *rudis*. Palpi orange. *Thorax* and scutellum grey, with three ill-defined black dorsal stripes. Pleura lighter grey. *Abdomen* blackish with pale indefinite spots. *Legs* black. *Wings* clear, fourth vein more sharply angled than in *rudis*, and nodal bristles of vein III stronger. Squamæ dirty whitish. Long 10-11 mm.

Described from four specimens, Masuri, 7,500 feet (U. P.), bred from *Cedrus deodara* (R. R. D. 805, B. C. R. 140, Cage 113,—January 1921, S. N. Chatterjee), forwarded to me for determination by Mr. Beeson, Forest Entomologist, Dehra Dun. Type and allotype in my own collection, other specimens in Forest Collection.

DEXOPOLLENIA.

DEXOPOLLENIA HAZARÆ, sp. nov.

Female. *Head:* frons one-third of head width at level of antennæ, frontal stripe dark, with sparse scattered short black hairs; ocellar triangle and parafrontals with dull bronzy-gold pile; parafacialia, facial ridges and genæ similar, a large black fleck on first of these at half length and all with black hairs. Face black, epistomal margin yellow. Antennæ and palpi black, the latter subclavate. Epistome exceptionally developed, two-fifths of head height viewed laterally. *Thorax* dark grey, the fore margin narrowly shining black, and with four dorsal black stripes fading posteriorly. Scutellum and pleura concolorous, the whole thickly developed in dull golden woolly pile. *Chætotaxy:* Acrostichals 2 : 3; Dorsocentrals, 2 : 3; equidistant and parallel to these is another row, 2 : 3, made up of interior presuturals and supra-alars; Humerals 3; Presuturals (in all) 4; Alars (in all) 3 : 1 : 1; Notopleurals 2; Propleurals (strong) 2; Mesopleurals 2; Sternopleurals 1 : 1; Scutellars an apical, sub-apical and 3 marginal pairs. *Abdomen* grey-black tessellate, pattern changing according to light incidence. *Legs* black, coxæ, especially front pair anteriorly, with pollen similar to thoracic pile. *Wings* clear, veins bare, squamæ whitish. Long 8 mm.

Described from a unique female in perfect condition, taken at Abbottabad, 4,120 feet, October 1922 (*Dutt*), in Pusa collection.

The location of this beautiful new species in the present genus is not quite certain for the following reasons:— the specimen is newly emerged and

the parafacialia are so folded over the antennæ that the facial carinae annot be properly made out, but it appears to be present; the parafacials are hairy, not bare. Notwithstanding these differences, the lateral discals and the yellow srinkled pile of the thorax lead me to place the species here, at least provisionally, until the male is known.

In this sub-family I have so far avoided new generic erection, and equally have not yet sunk any of Townsend's genera. The result of excessive splitting, of which Townsend is the High-Priest, must ultimately be the multiplication of genera until practically every species has its own genus, or else the flood must be stemmed by meting out to many such genera the fate of their Culicid relations erected by Theobald. Such is my ultimate intention, but before doing so it is necessary to arrive at some approximate finality in regard to the tale of the species, and that is obviously not yet attained.

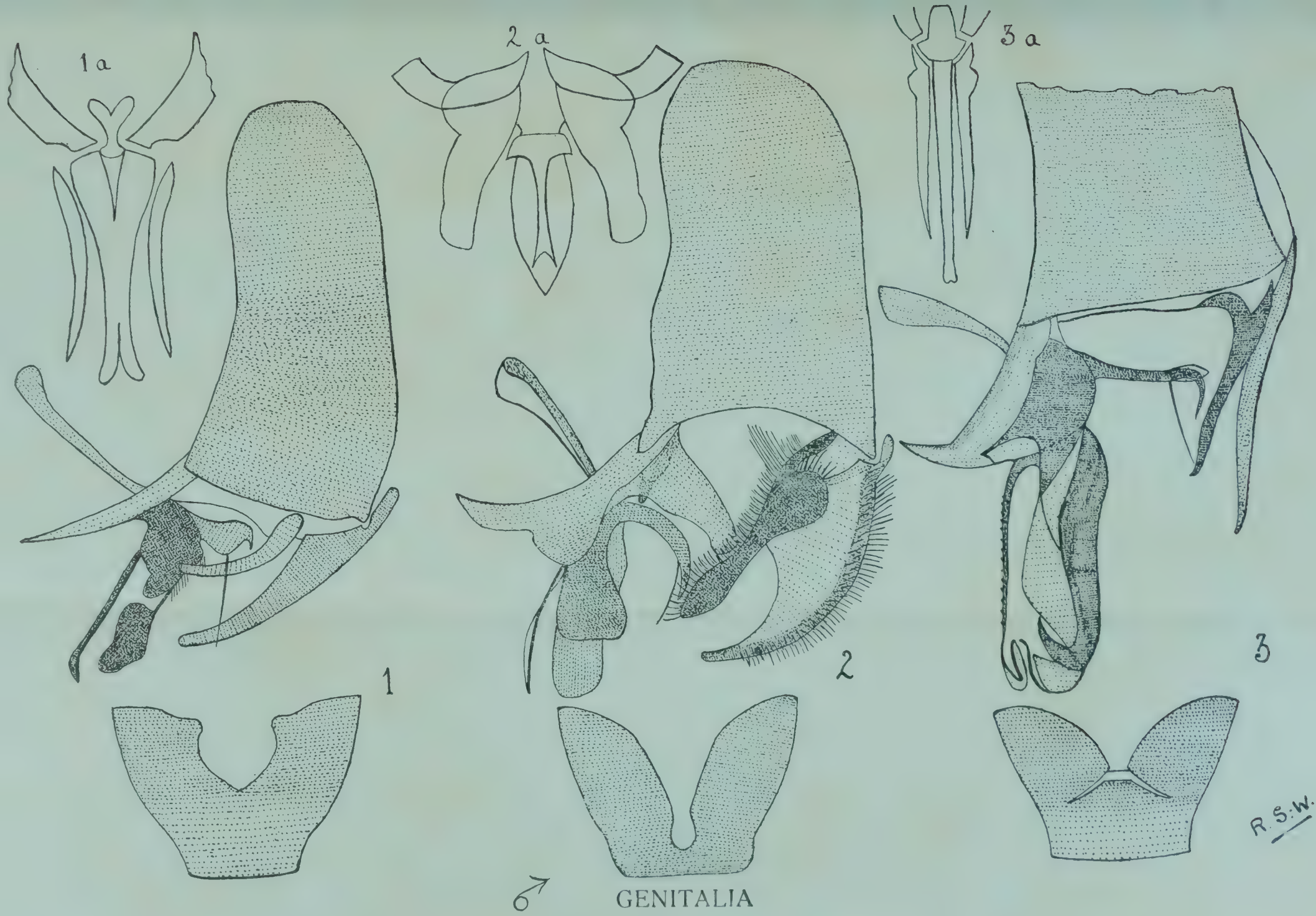


Fig. 1. Strongyloneura nepalana, Townsend.
Fig. 2. Strongyloneura viridana, Townsend.
Fig. 3. Strongyloneura nebulosa, Townsend.
(Figs. marked "a" are end views.)

PLATE II.

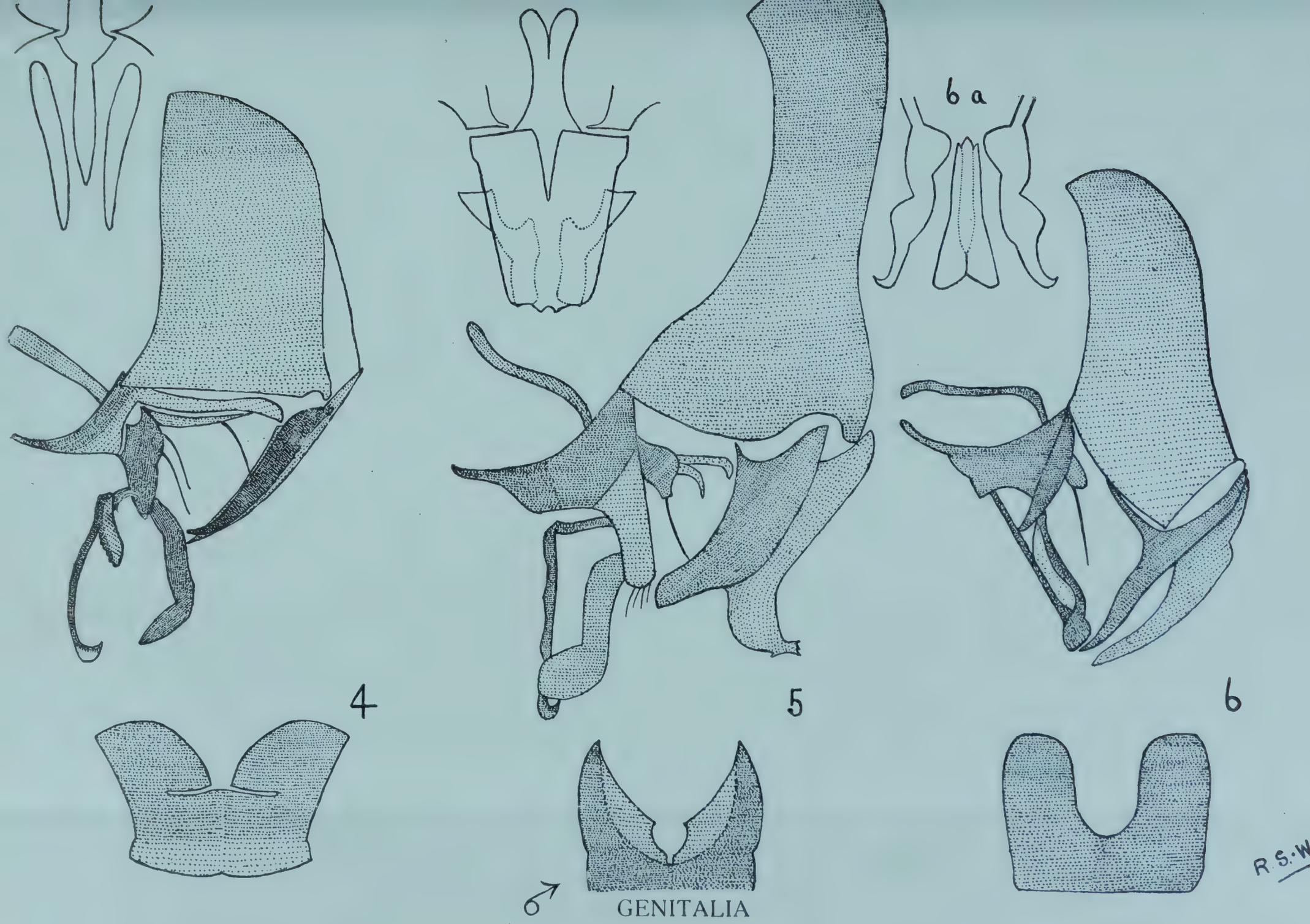
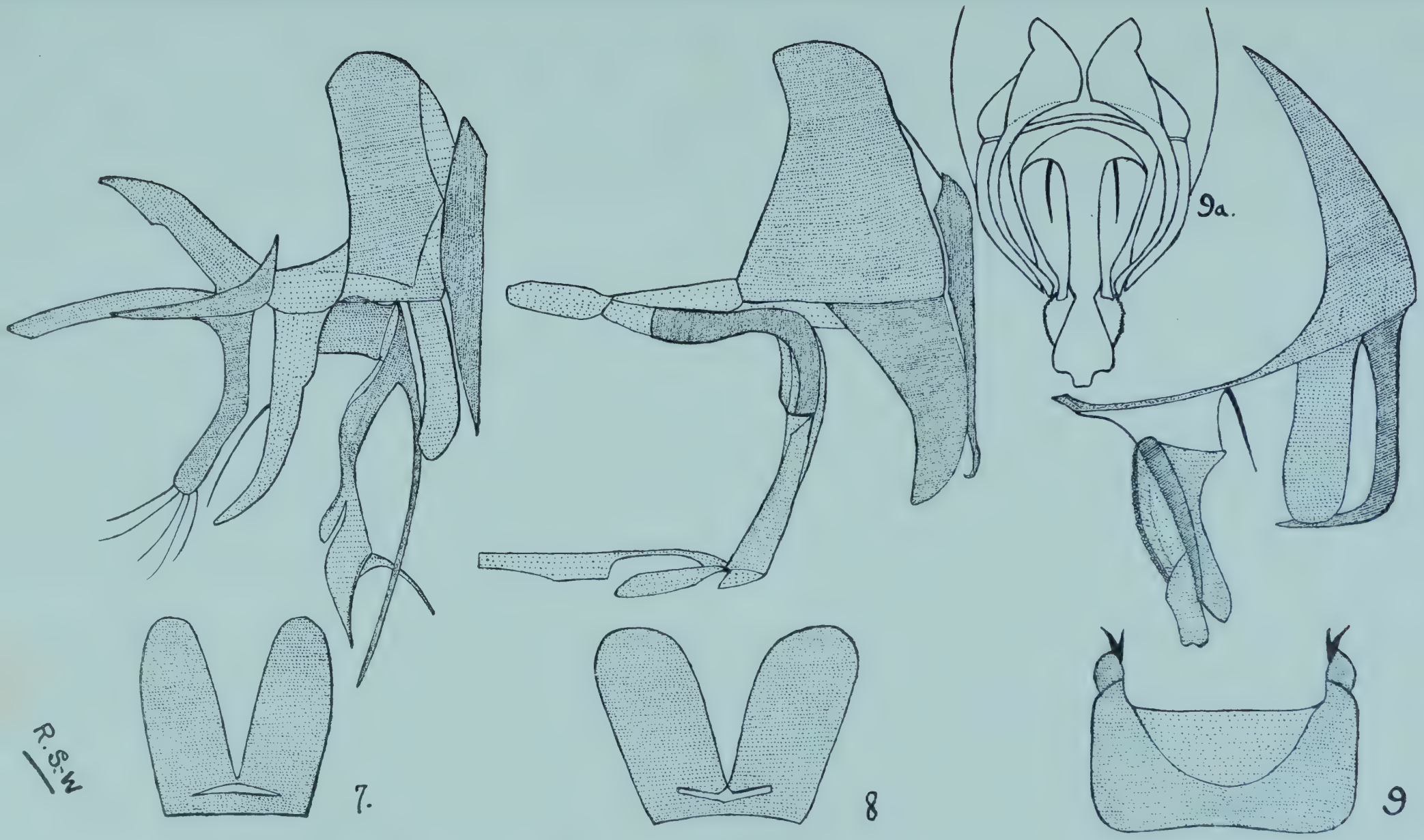


Fig. 4. Stongyloneura cœrulana, Townsend.
Fig. 5. Synamphoneura cuprina, Bigot.
Fig. 6. Cosmina indica Senior—White.
(Figs. marked "a" are end views.)



♂ GENITALIA

Fig. 7. Pollenia rudis, Fabricius.
Fig. 8, Pollenia indica. Senior-White,
Fig. 9, Rhinia testacea, Robineao-Desvoidy.
(Figs. marked "a" are end views.)

PLATE IV.

PAPERS ON INDIAN TABANIDÆ.

BY

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I. A PRACTICAL AND SIMPLE METHOD FOR REARING TABANID LARVÆ.

Introduction.

Since 1760, when Degeer, the Swedish Naturalist, published a paper on the larval and pupal stages of *Tabanus bovinus*, L., the European horse-fly, this being the earliest account of any observation on the pre-imaginal phase in the life-history of Tabanids, many others have written on the development of Tabanidæ, but it is only in recent years that any one has produced an account touching on all the successive stages in the growth of these insects. The chief reason for this is that, apart from their general interest to the student of Entomology, although recognised as blood-sucking pests of cattle, keen interest was taken in them only after they were suspected of infecting stock with anthrax and surra. This happened in 1902, about which time, following an importation of Indian zebu cattle, there occurred an outbreak of surra in the United States of America.

Historical.

A perusal of literature on the life-history of Tabanids shows that all methods of rearing so far attempted have been unsatisfactory. Hine[1] (1906) was the first to use any kind of rearing apparatus and advocated, after some experimental work, jelly-glasses having the cover perforated with a few holes and containing moist sand to a depth of 3 inches, covered over the top with a

[1] Hine (1906). Habits and life-histories of some flies of the family Tabanidæ (*U. S. Dept. Agri. Bureau Entomology, Technical Series* 12, pt. 2.)

quantity of fine leaves of water plants, and supplying minute aquatic invertebrates, chiefly crustaceans, for food. King[1] (1908) used small glass basins containing mud, water and growing grass and fed the larvæ on freshly-killed mosquito larvæ and earthworms. Neave[2] (1915) reared the larvæ in small basin-shaped vessels of hard clay, varying from 6 inches to a foot in diameter, containing wet mud or sand, and for food he supplied larvæ of Muscid flies and freshly-killed small tadpoles, molluscs and fish fry. Mitzmain[3] (1913) improved on Hine's method. He kept the larvæ separately in glass jars, one-third filled with clean wet sand and provided with strips of filter paper soaked in muck from a creek bottom. Minute crustaceans, mosquito larvæ and young angleworms furnished the diet.

Patton and Cragg[4] (1913) preferred to Hine's method the use of large galvanised iron trays six feet long and six inches deep, and three quarters filled with water and with sand and mud sloped off to form a bank above the water level, and stocked with water plants, small crustaceans and earthworms. Marchand[5] (1917) found it satisfactory to use test-tubes about seven and three-quarter inches long with a roll of filter paper and about half an inch of water in them, providing earthworms and bits of meat for food.

Drawbacks of above methods.

Obviously, except in Marchand's method, it is impossible in these to secure reliable *data* on the growth and the occurrence of moults. The environment obtained in Marchand's tubes is bound to be very unlike that under natural conditions. Repeated attempts, made by the present writer to rear just-hatched larvæ in such tubes, proved a failure, as the larvæ died in a few days. In the tray recommended by Patton and Cragg for rearing Tabanids in large numbers, according to the authors one should start only with at most fifty larvæ and finally from this about one-fifth will reach maturity. Hine's principle of segregating these highly predaceous larvæ in individual jars is excellent, and in this paper it will be shown how his method has been improved upon to provide at once all the necessary natural conditions

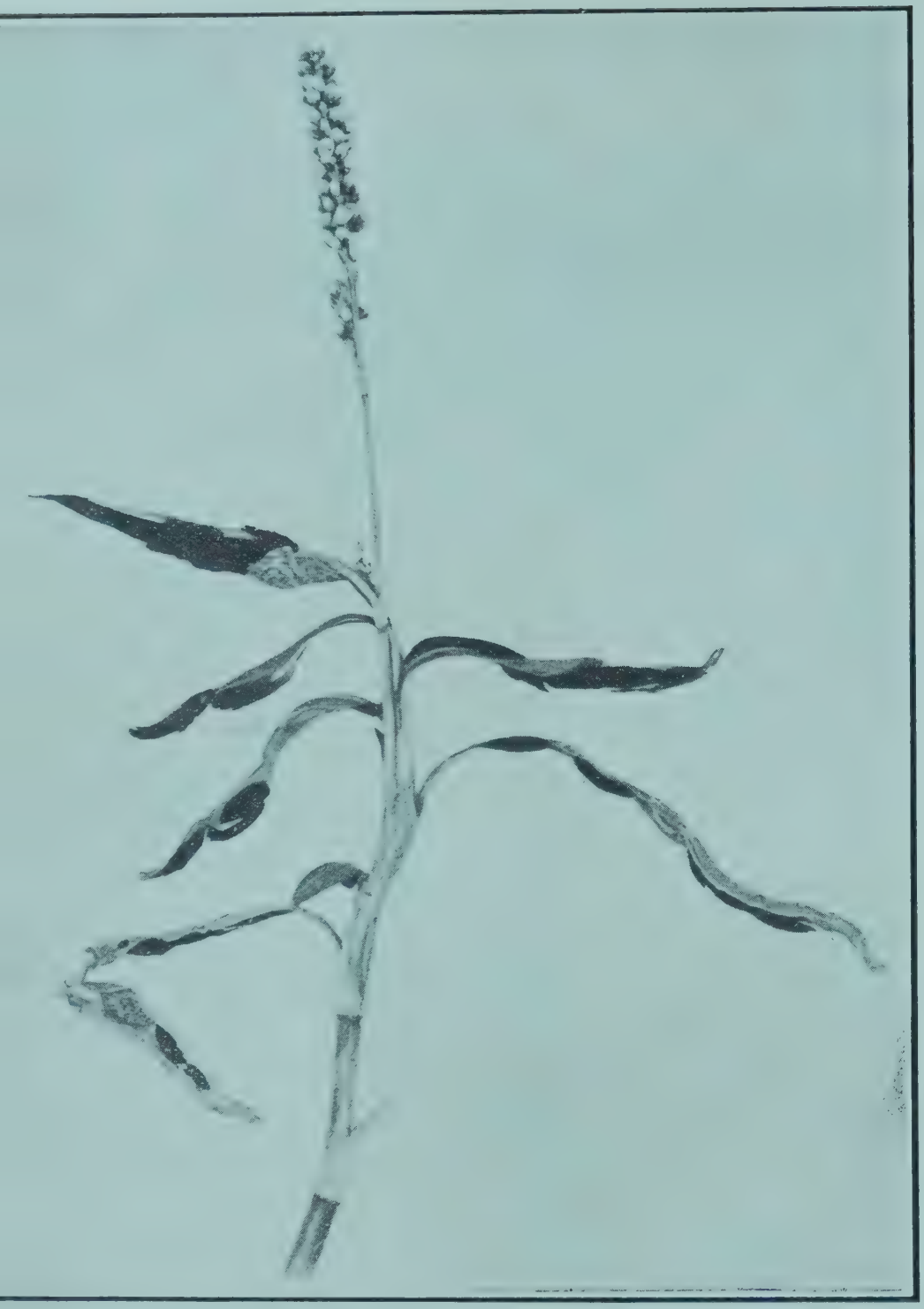
[1] King (1908). Report on Economic Entomology. (*Third Report, Wellcome Research Laboratory, Khartoum.*)

[2] Neave (1915). The Tabanidæ of Southern Nyasaland, with notes on their life-histories. (*Bull. Entom. Res.*, Vol. V.)

[3] Mitzmain (1913). The biology of *Tabanus striatus*, Fabr. (*Phil. J. Sc. Section B*, Vol. VIII.)

[4] Patton and Cragg (1913). *Text-Book of Medical Entomology.*

[5] Marchand (1917). An improved method of rearing Tabanid larvæ. (*Journal of Economic Entomology Concord*, Vol. X.)



I. A branch of *Polygonum glabrum* from the edge of a river.

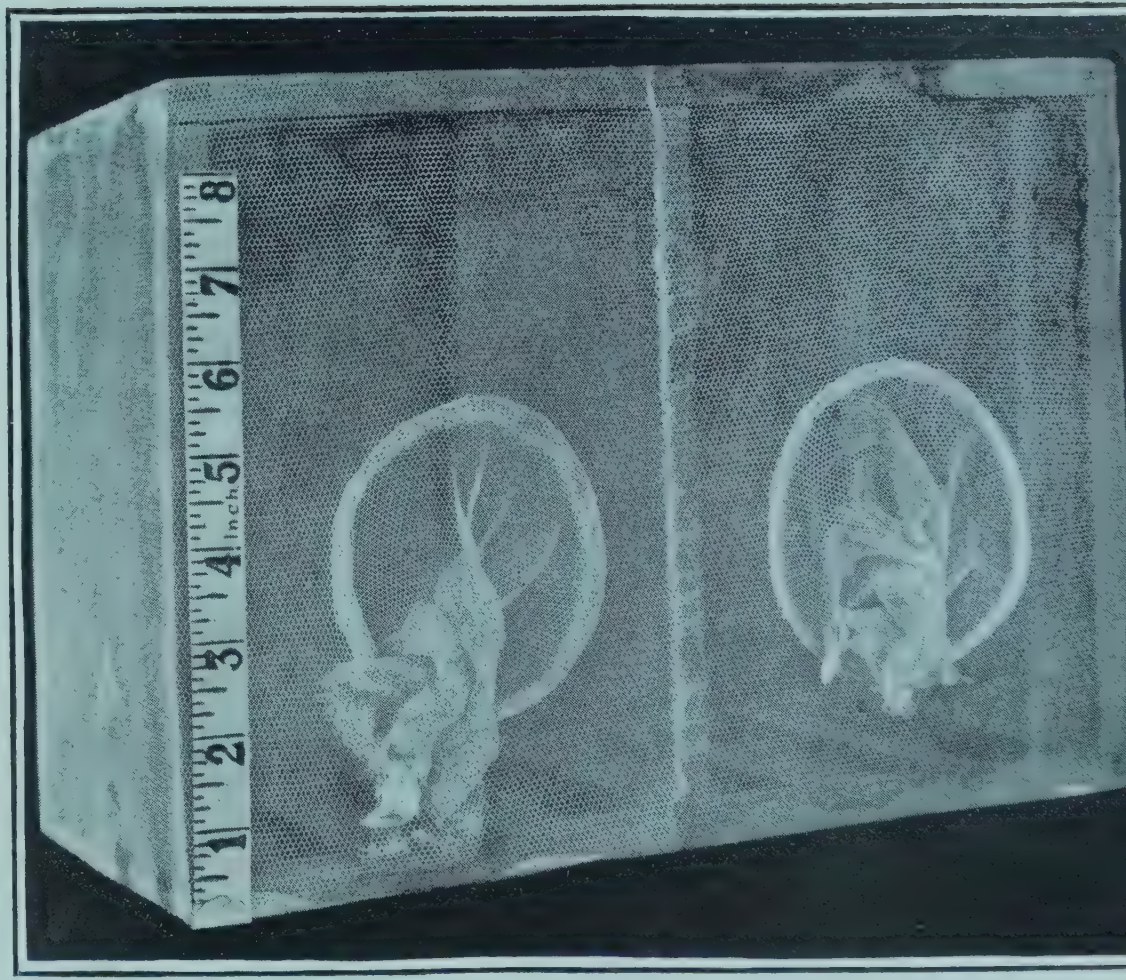


Fig. 2. Cage used for keeping adult female Tabanids.

and facilities for the close observation of the progress of growth of the larva.

Method recommended.

If it is desired to follow a life-history closely it may be possible to collect egg-masses from where they are laid in nature. Most Tabanids lay their eggs on plant stems or leaves overhanging water at the edges of streams, irrigation channels or pools. The flies may also be captured specially off an animal they frequent for blood and the full-fed ones may be let into a cage of dealwood framework and mosquito netting and of dimensions as shown in Plate V, fig. 2. There are two compartments each with a sleeved opening. This arrangement gives both rigidity to the cage and also room for keeping two species at one time. It is sometimes possible to get a caught female to feed occasionally on a cow, pony or rabbit and to keep it in this cage until it lays eggs. The cage should be kept in a shallow tray with about an inch of water and the whole placed on a verandah or other suitable place where there is plenty of light, air and sunshine. The egg-masses are generally laid on the wooden framework and occasionally on the netting ; in either case it is easy to cut them out with some of the foundation. By this method one can have the exact date, and sometimes the hour, when the eggs were laid.

The egg-mass after collection is hung, by means of a bent wire or other suitable device, over a little water kept in a small glass beaker of about 4 oz. capacity. The eggs hatch in a few days, generally at the time of sunrise, and the larvæ fall into the water. All Tabanid larvæ seem to do a moult directly they reach water after hatching. The second-instar larvæ must now be examined to decide what will be a suitable condition to transfer them into. Some have large lateral tracheæ and float on the water, others have narrow tracheæ and sink. The first kind require a certain amount of water, whereas for the second free water is fatal. Glass beakers, similar to the size used first, are taken and filled about one-eighth inch with clean river sand which has been washed several times until, when shaken up with water, it settles down quickly and leaves the water clear. Some clean water is poured into the beaker with the sand and shaken up with the beaker slightly tilted and then allowed to settle so that the sand forms a sloping bank. A little water is allowed to remain at the bottom or all water is poured off according to the needs of the case. About eight such beakers may be prepared and numbered and with a pipette a definite number of larvæ, say four, starting on the second-instar are transferred into each of the first five and the rest of the larvæ may be divided equally into the other three. All these beakers

may be kept in a glass tank with half an inch of water in it and having a wire gauze cover.

Fly maggots, collected from cow-dung and killed by being kept overnight in a jar of water, were found suitable as food for all the species reared at Pusa. One or two maggots in the first five beakers and a few in the others are buried in.

The glass beakers let in plenty of light for examination of contents and when maggots are used as food the cages remain clean, developing neither odour nor dirt, which might happen when other material, as earthworms or meat, is used. Daily observation may now be kept on the larvæ in the first five and the others may be occasionally attended to for cleaning and feeding. For examination, each beaker is taken up and about quarter filled with water and slowly shaken up when the larvæ and the maggots and any moult skin that there is float up. By the change in colour and size it is easy to say if the larvæ have fed. After examination the excess water that has been added is drained off carefully and the beaker left as before.

If the larvæ do feed on the maggots at this stage only one larva is kept in each of the first five beakers ; but if they are predaceous, as may be easily known by the appearance of dead bodies of Tabanid larvæ in the beakers, they may be allowed to destroy one another ; but in every case daily notes should be kept for the first five beakers so that when a moult skin does appear there will be no confusion with a dead larva. With some experience it is easy at this stage to distinguish with the help of a hand-lens or a watch-maker's eye-glass, between moult skins and carcases of larvæ which have been preyed on. A larva which has done the second moult may also in case of doubt be made out by the longer chitinous rods in the head and also usually by an increase in the number of the paired black bodies in what is called Graber's organ at the posterior end of the body.

After the second moult it is best to keep at least five beakers with a single larva in each and, if it is desired to secure a large number of imagines, a few more beakers with a small number of larvæ in each of them. Soon after the third moult the larvæ become very active and will often leave the beaker and travel long distances and thus be lost. Therefore at this stage glass jars of about 6 oz. capacity should be substituted for the beakers and their mouths should be covered with a thin piece of silk and an inverted Petri dish over it.

A third-instar larva will feed on two or three fly maggots in 24 hours and an almost full-grown one on about seven. When the larvæ are full-grown they will refuse to feed any more and one can see that the fly maggots supplied

Fig. 1. Glass beakers and jars used for breeding Tabanid larvæ.

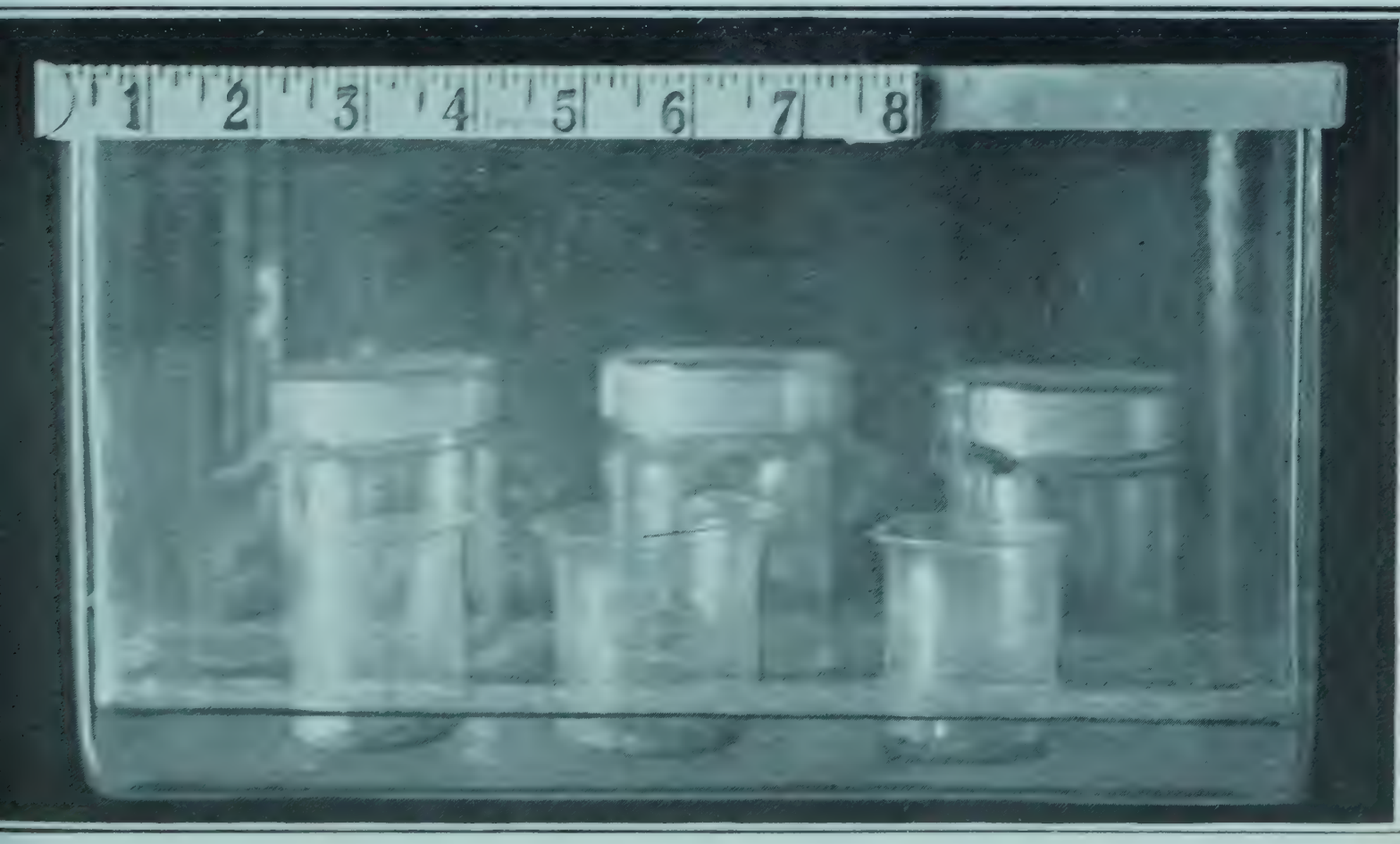
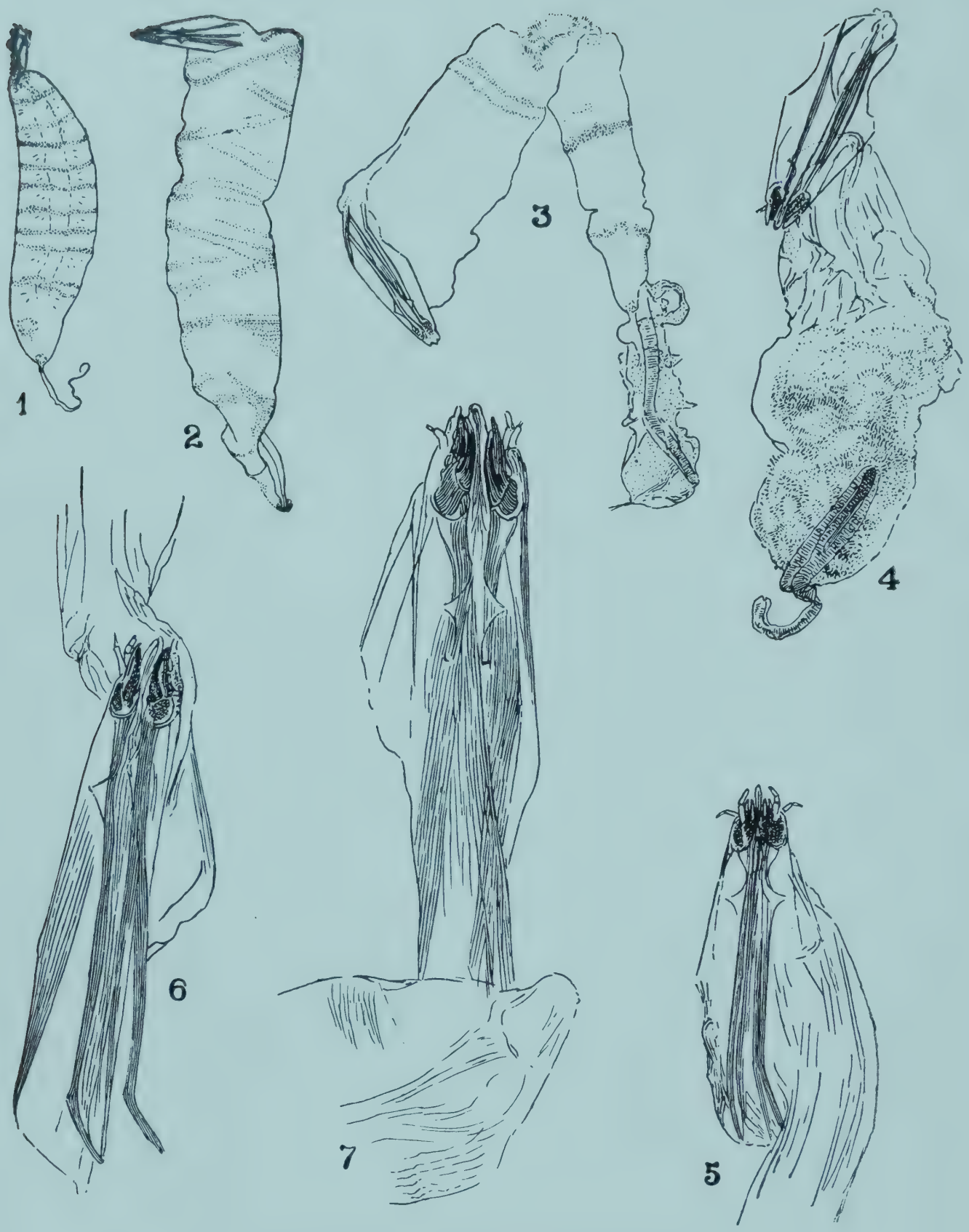


Fig. 2. Glass tank with breeding vessels in it.



The number of Moults in Tabanid Larvæ.

1. First moult (× 24).
2. Second moult (× 24).
3. Third moult (× 24).
4. Fourth moult (× 20).
5. Fifth moult, only head and part of cuticle (× 20).
6. Sixth moult, only head and part of cuticle (× 20).
7. Seventh moult, only head and part of cuticle (× 20).

are not attacked. Feeding may now be stopped. The larva now tends to show a more yellowish tint internally. Now more dry sand is introduced to fill about half the jar and just enough water poured in to keep the sand slightly damp. The jars may be examined daily to note when the larvæ pupate. After pupation in the course of a few days the adult will emerge and be found within the empty space in the jar.

The above method, it may be said in conclusion, is not suitable for certain peculiar Tabanids that breed in strange situations, as *Gastroxides ater*, Saunders, whose larvæ and pupæ are found in the silt in tree holes.

II. THE NUMBER OF MOULTS IN TABANID LARVÆ.

FROM the observations of Mitzmain[1] (1913) on the life-history of *Tabanus striatus*, Fabr., it has been generally believed that Tabanid larvæ moult thrice, passing into the pupal stage after the third moult. Previous workers have left no record of moults except King[2] (1908) who noticed in the case of *T. biguttatus*, Wied., the shed larval skin adhering to the pupa—a statement of no value as far as the number of moults are concerned—and Paoli[3] (1907) who also mentions moults in connection with his study of Gräber's organ. Cross and Patel[4] (1921) have noted a first moult which takes place in the case of *Tabanus bicallosus*, Ric., within 10 to 15 minutes after hatching and in *T. rubidus*, Wied, (=*T. albimedius*, Wlk.,) within 20 to 30 minutes after hatching.

During the year 1923 several species of Tabanids were reared at Pusa and the improved method described in a previous paper of mine enabled one to follow the development of and moults in the larva closely and accurately. As a result it has been discovered that there are really seven moults, the larva turning into pupa at the seventh moult (Plate VII). This has been the case in *T. rubidus*, Wied. (= *albimedius*, Wlk), *T. striatus*, Fabr. (= *hilaris*, Wlk.) and *T. tenens*, Wlk.

[1] Mitzmain (1913). The biology of *Tabanus striatus*, Fabr. (*The Philippine Journal of Science ; Section B, Tropical Medicine*, Vol. VIII.)

[2] King (1908). Report on Economic Zoology. (*Third Report of Wellcome Research Laboratory, Khartoum.*)

[3] Paoli (1907). Intorno all'" Organo del Gräber " nelle larve di Ditteri Tabanidi. (*Redia*, Vol. IV.)

[4] Cross and Patel (1921). Surra transmission experiments. (*Dept. of Agriculture, Punjab, Veterinary Bulletin* No. 5.)

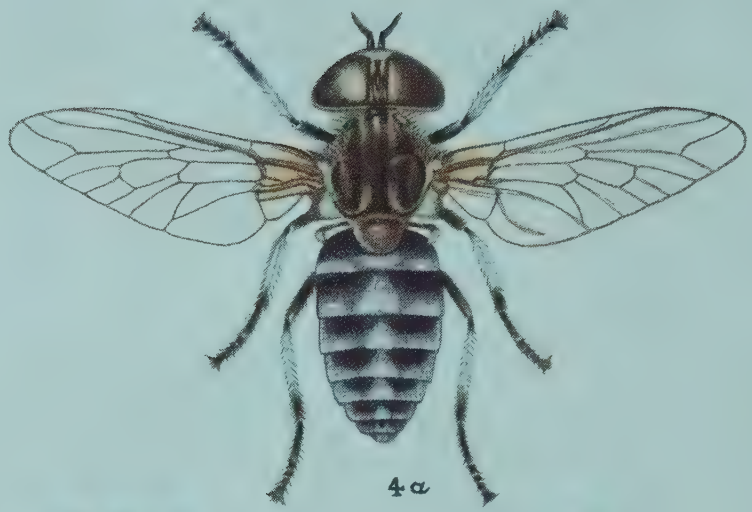
The following is a record of the early stages of *T. rubidus*, Wied. :—

Date			
April 10 ..	Eggs laid.		
„ 14 ..	Eggs hatched at 9-40 A.M.		
„ 14 ..	First moult over at 9-55 A.M.		
	Larva No. 1	Larva No. 4	Larva No. 6
„ 18 ..	Second moult	..	..
„ 20 ..	..	Second moult	Second moult
„ 21 ..	Third moult	..	..
„ 23 ..	..	Third moult	Third moult
„ 24 ..	Fourth moult	..	..
„ 25 ..	..	Fourth moult	..
„ 26 ..	..	..	Fourth moult
„ 27 ..	Fifth moult	..	..
„ 29 ..	..	..	Fifth moult
„ 30 ..	..	Fifth moult	..
May 4 ..	Sixth moult	..	..
„ 5 ..	..	..	Sixth moult
„ 7 ..	..	Sixth moult	Just before 11 A.M.
June 2 ..	..	At 11 A.M. Seventh moult : pupated	Seventh moult : pupated
„ 9 ..	..	..	..
„ 10 ..	..	Male fly emerged	Female fly emerged
„ 18 ..	Seventh moult: pupated		
„ 25 ..	Male fly emerged		

Although in all rearings of the above three species seven moults have always been observed, the case of *T. crassus*, Wlk., is an exception. In this species alone eight larval moults have been counted. *T. crassus*, Wlk., is one of the largest Indian Tabanids, and shows remarkable variation in colour between the sexes and has also a much longer larval period than in any of the other species studied and this may be the reason for an extra moult in it.

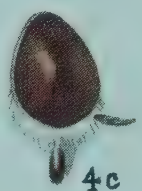
1a

1b



4a

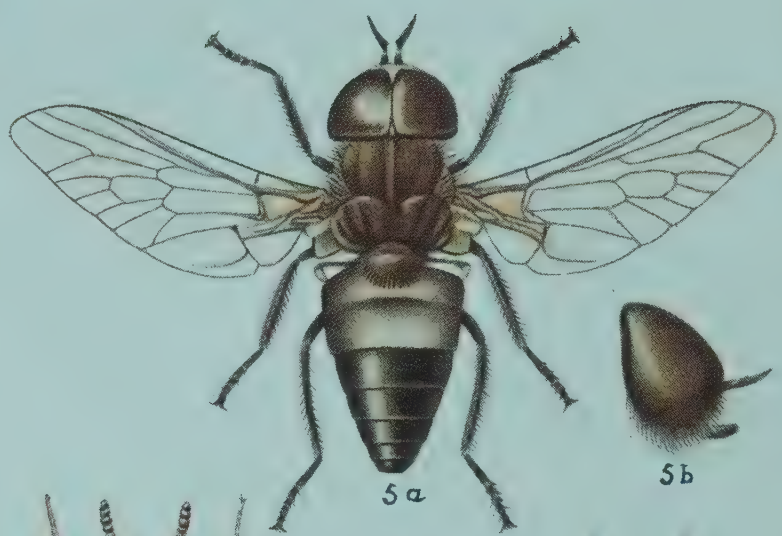
4b



4c

3

2b 2a



5a

5b

6

7

It may be noticed here that in all larvæ of Tabanids mentioned above, the first instar larvæ present a peculiarity which has not been hitherto observed. This larva is unable to feed and the moult skin exhibits a head adapted to break the chorion and allow the larva to hatch out, a strong anterior dorsal spine being the chief feature of this mechanism.

III. THE LIFE-HISTORY OF *TABANUS CRASSUS*, WLK., AND THE IDENTITY OF THE FEMALE OF THE SPECIES.

Introduction.

Tabanus crassus, Wlk., is one of the largest flies of the genus *Tabanus* found in India. Nothing is known of its habits although it is quite likely that the female sucks blood from vertebrate animals. The very peculiar appearance of the egg-masses and lack of exact evidence as to what species they belonged to were the immediate reasons for studying the life-history recorded here. In the Pusa collection there are a few flies of this species collected from Pusa and one from the Khasi Hills, Assam. Other localities from which it has been recorded are Karwan (probably for Karwar) North Kanara, India; Lushai Hills, Burma, Java, Hongkong, Malacca and Formosa.

Explanation of Plate VIII

Tabanus crassus, Wlk.

1a.	Egg-mass on leaf	× 1
1b.	Single egg	× 10
2a.	Second-instar larva	× 16
2b.	Mature larva	× 2
3.	Pupa	× 2
4a.	Adult female	× 2
4b.	Front view of head of female, magnified.	
4c.	Side view of the same, magnified.	
5a.	Adult male	× 1
5b.	Side view of head of male, magnified.	
6.	Female egg-parasite	× 24
7.	Male egg-parasite	× 24

Pre-imaginal Stages.

The egg. The egg-masses, though rare, are conspicuous objects and have been collected at Pusa from leaves of plants overhanging water along a river bank. The eggs are laid vertically and packed close together to form an elongate hexagonal mass about 10 mm. long and 5 mm. broad. A white chalky substance is plastered thickly over the top and very thinly on the sides.

Each egg is a black narrow elongate slightly curved body about 2·5 mm. long and about 0·3 mm. broad at its thickest part. There are about 500 eggs in each egg-mass.

The just hatched larva is about 2 mm. long, of a yellowish-white colour and almost torpedo-shaped, but slightly blunt at the head end. The head is withdrawn into the body which shows eleven segments and a terminal siphon. The head has certain hatching spines in this stage, but this larva moults

1b

4a

1a

4b

3

5a

5b

6

7

2a

2b

EXPLANATION OF PLATE VIII

Tabanus crassus, Wlk.

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1b.	Single egg	.. .. ..	× 10
2a.	Second-instar larva	.. .. ..	× 16
2b.	Mature larva	.. .. ..	× 2
3.	Pupa	.. .. ..	× 2
4a.	Adult female	.. .. ..	× 2
4b	Front view of head of female, magnified.		
4c.	Side view of the same, magnified.		
5a.	Adult male	.. .. ..	× 1
5b.	Side view of head of male, magnified.		
6.	Female egg-parasite	.. .. ..	× 24
7.	Male egg-parasite	.. .. ..	× 24

It may be noticed here that in all larvæ of Tabanids mentioned above, the first-instar larvæ present a peculiarity which has not been hitherto observed. This larva is unable to feed and the moult skin exhibits a head adapted to break the chorion and allow the larva to hatch out, a strong anterior dorsal spine being the chief feature of this mechanism.

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within a few minutes of hatching and the second-instar larva is provided with mouth-parts adapted for feeding.

The full-grown larva has the usual Tabanid appearance, is yellowish-white in colour, and when fully extended is 35 mm. long. The head is completely retractile within the body which is clearly divided into eleven segments and the eleventh bears a siphon tube. The junction of the segments is marked by a grey band. Just posterior to this band the fourth and tenth and all segments between them have on a slightly thickened ridge another grey band which appears to carry a double row of closely set minute spines that encircle the whole segment, being also present in bunches on all the parapodia, of which there is a transverse row of six on each of these segments, one on either side and four on the venter. The parapodia are small muscular retractile processes which act as locomotor organs. The spines on them are slightly better developed than elsewhere, but not so prominent as in certain other Tabanids. The eleventh segment, which carries the anal opening, tapers away from the body and has a terminal process, the siphon tube, which is at times completely withdrawn into the body and which carries at its extremity the two almost contiguous vertical spiracles.

The pupa is about 18 mm. long and in general features resembles that of other Tabanids.

Life-history.

The incubation period has not been obtained as the time of laying has never been observed. From notes on a large number of egg-masses collected and hatched it is presumed that this period is about 5 to 7 days. The just-hatched larva moults immediately on falling into water and the second-instar larva, which possesses narrow lateral tracheal trunks, sinks in the water and crawls into the moist earth at the water edge. In the laboratory the larvæ were reared in damp sand and were fed on freshly-killed fly maggots collected from cow-dung. The larval stage in summer occupies about 15 weeks. The pupa is found in damp sand and the pupal period during the same season is about 18 days. Below is the record of one lot of adults reared from an egg-mass collected in the month of June.

Date			
June 28 ..	Egg-mass collected from river bank.		
July 3 ..	Larvæ hatched and did first moult.		
	Larva No. C_1	Larva No. F_1	Larva No. IV
,, 11 ..	Second moult	Second moult	Second moult
,, 21 ..	Third moult	Third moult	Third moult
,, 26 ..	..	Fourth moult	..
.. 27 ..	Fourth moult	..	..
,, 30 ..	..	Fifth moult	..
,, 31 ..	Fifth moult	..	..
August 2 ..	..	..	Fifth moult
,, 3 ..	..	Sixth moult	..
,, 5 ..	Sixth moult	..	..
,, 8 ..	..	..	Sixth moult
,, 12 ..	..	Seventh moult	..
,, 16 ..	Seventh moult	..	..
,, 19 ..	..	..	Seventh moult
October 14 ..	Eighth moult : pupated	..	..
,, 17 ..	..	..	Eighth moult : pupated
,, 20 ..	..	Eighth moult : pupated	..
,, 31 ..	Female fly emerged	..	..
November 5 ..		..	Female fly emerged
,, 8 ..		Male fly emerged	

Number of instars.

The larvæ, it will be seen from the above Table, passed through eight instars, whereas the rule in Tabanids seems to be seven instars.

Broods.

There are three broods at Pusa, one from about March to June, the second from June to October, and a third from October to the following March, hibernation in the larval stage taking place in this brood.

Natural enemies.

A Scelionid parasitizes the eggs and sometimes every egg in an egg-mass is destroyed by this.

The female of *T. crassus*, Wlk.

There is no previous direct information as to the identity of the female of this species—rarely have the two sexes of any Tabanid been seen together. From the rearing work undertaken at Pusa authentic females of the species have been obtained and they agree with the description of what Walker[1] (1850) has named *T. sanguineus*, of which only females are known. In the case of *T. crassus*, Wlk., the species is described by Walker[1] (1850) from male specimens and Ricardo[2] (1911) states that *T. basalis*, Macq., may prove to be its female. It is now definitely proved that *T. crassus*, ♂, Wlk., and *T. sanguineus*, ♀, Wlk., are conspecific and as the first name has priority the name *T. sanguineus*, Wlk., becomes a synonym.

[1] Walker (1850). *Insecta Saundersiana*, Vol. I.
[2] Ricardo (1911). *Records of the Indian Museum*, Vol. IV, No. VI.

August 1924 ENTOMOLOGICAL SERIES VOL. VIII, No. 6

MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

No. 6. TWO DROSOPHILIDÆ FROM COIMBATORE

BY

J. R. MALLOCH

AGRICULTURAL RESEARCH INSTITUTE, PUSA

PRINTED AND PUBLISHED FOR

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BY

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TWO DROSOPHILIDÆ FROM COIMBATORE.

BY

J. R. MALLOCH.

[Received for publication on 22nd February 1924.]

Amongst some Diptera sent me recently for identification I found the two which are described herein. Both are evidently of economic importance, one feeding on fruit and thus to some extent injurious, and the other feeding upon Aphides and consequently beneficial.

Genus *Gitonides*, Knab.

Generic characters. Cephalic chætotaxy : postverticals small ; ocellars long, divergent ; each orbit with three strong bristles below the vertical one, the upper one in line with posterior ocelli, the middle one a little closer to the lower one than to the upper and, like the latter, backwardly directed, the lower one forwardly directed and farther from base of antennæ than from the median bristle ; entire frons with numerous short microscopic black setulæ ; face slightly convex, not keeled ; vibrissæ well developed ; antennæ as in *Drosophila*, but the arista is bare ; eyes large, bare. Thoracic chætotaxy : one short humeral ; presutural intra-alar short ; dorsocentrals two pairs, the anterior pair short and close to the larger pair ; scutellars four, the disc bare, prescutellar acrostichals large ; mesopleura bare ; sternopleurals 1 : 1 ; other characters as in *Drosophila*. Wing venation as in *Amiota*, Lœw, the discal and second basal cells separated by a cross-vein ; first posterior cell not narrowed apically, costa indistinct beyond apex of third vein.

Genotype, the following species :—

Eudrosophila perspicax, Knab.

Male and female. Habitus and colouration similar to *Drosophila repleta*, Wollaston. Brownish testaceous, opaque, thorax with grayish pruinescence, frons and dorsum of thorax profusely mottled with dark brown dots, one at base of each hair and bristle, on the dorsum of thorax more or less

aggregated in the form of interrupted vittæ and irregular groups ; disc of scutellum mottled with brown and a rather conspicuous dark brown spot at base of each bristle ; a narrow brown vitta along upper margin and another along middle of pleura. Abdomen dark brown, apices of tergites testaceous. Legs testaceous. Wings hyaline.

Dorsum of thorax rather closely covered with short black setulose hairs. Abdomen ovate. Legs without abnormal armature, mid and hind tibiæ rather stout. Inner cross-vein slightly beyond middle of discal cell ; first vein ending almost above middle of antepenultimate section of fourth vein ; last section of fourth vein a little less than twice as long as penultimate section ; distance from apex of first vein to apex of second nearly three times as great as preceding costal section.

Length, 3·5—4 mm.

Several specimens, " amongst plant lice (young ones of the Fulgorid, *Pundaluoya simplicia*) on *cholam* shoot," Coimbatore (*Y. Ramachandra Rao*). Also " on cotton mealy bug " (*Pseudococcus corymbatus*, Green), Coimbatore, 13th March, 1920 (*T. V. Ramakrishna Ayyar*).

Originally described from Hawaii and occurs also in the Philippines. Sturtevant in his paper on the North American Drosophilidæ sunk this genus as a synonym of *Gitona* but in that genus the discal and second basal cells are not separated by a cross-vein, a fact noted by him, while the reverse is here the case.

Pinned with the male there is a puparium, but not the one from which the specimen emerged, as the puparium contains the undisclosed imago. This puparium is subopaque reddish brown in colour, 6 mm. in length and almost 2 mm. in width, with the ventral surface slightly flattened, the sides bulging a little, and the upper surface convex. The dorsal surface has the anterior fourth obliquely sloped to anterior margin as in most Drosophilidæ and the posterior extremity is not much attenuated, differing in this respect from the forms which live in liquids and semi-liquid matter. Anterior spiracular organs short, with about 13 short pale branches arranged fanwise at apices ; posterior spiracular trunks contiguous at bases, consisting of two upwardly diverging stalks which taper apically, are furnished with three small spiracular slits at tips, and are about twice as long as their basal diameter. Body covered with microscopic points, the segments moderately well defined.

Drosophila biarmipes, sp. n.

Male and female. Testaceous yellow, thorax and abdomen more or less shining. Head and thorax unicolourous. Abdomen with a dark border to

each tergite, in male with the apical two tergites largely or entirely dark brown. Legs yellow. Wings hyaline, in the male with a faint darker tinge at apices of second vein. Halteres yellow.

The male has the orbital bristles and ocellar bristles very small, the anterior proclinate orbitals being particularly minute, while in the female only the anterior reclinate bristle is minute, the others being well developed ; arista with 5 rays above and two below ; facial carina large, rather broad and flat on most of its length ; cheek linear ; one or two strong setulæ below vibrissa ; eyes hairy. Thorax with 8 series of intradorsocentral setulæ ; prescutellar acrostichals indistinguishable ; sternopleurals 1 : 1. Hypopygium of male more prominent than usual in the genus. Fore tarsus of male with two combs of short black bristles on basal segment on its inner surface, one at middle and the other at apex ; fore tarsus of female normal. Section of costa in front of apex of second vein in male a little over twice as long as the one behind it, in female fully 2·5 times as long ; penultimate section of fourth vein in male a little over twice as long as ultimate, in female over 2·5 as long as ultimate ; outer cross-vein at about 1·5 its own length from apex of fifth vein in male, about twice its own length in female.

Length, 2-2·5 mm.

Type, male, and allotype, Coimbatore, 30th August 1920. Paratype male and female, same locality, 24th August 1920. Reared from *Nim* (*Melia azadirachta*) fruit (Ballard).

August 1924 ENTOMOLOGICAL SERIES VOL. VIII, No. 7

MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

No. 7. A NEW APHIDIPHAGOUS FLY FROM COIMBATORE

BY

J. R. MALLOCH

AGRICULTURAL RESEARCH INSTITUTE, PUSA

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A NEW APHIDIPHAGOUS FLY FROM COIMBATORE.

BY

J. R. MALLOCH.

[Received for publication on 22nd February 1924.]

In 1921 I published a revision of the North American species of the genus *Leucopis*,* in which I erected two new subgenera for the reception of new species which differed in chætotaxy from those previously known.

Each of these subgenera contains but one species, that relegated to *Leucopomyia* feeding in the larval stages on the cottony maple scale (*Pulvinaria vitis*, Linné), and the one placed in *Neoleucopis* probably an enemy of Aphids on pine.

In the material sent to me from Coimbatore I find two species which are referable to the genus Leucopis *sens. lat.*, one being a true *Leucopis*, while the other belongs to *Neoleucopis*. The latter is new and is described herein; the former is probably new also, but the specimens are not sufficiently well preserved to warrant my describing the species at this time.

Leucopis (*Neoleucopis*) *luteicornis*, sp. n.

Male and female. Fuscous, densely covered with whitish gray pruinescence which entirely obscures the ground colour. Interfrontalia when seen from in front dark gray, much darker than the pale orbits and lunule; antennæ and palpi luteous, arista brown apically. Thorax with dorsum marked with two complete brown vittæ in line with the dorsocentral bristles, the margins of which are not sharply defined, and two pale gray slender vittæ between these on anterior margin which do not extend beyond suture. Abdomen with dorsum of first visible tergite blackish except in middle, second tergite

* "The subfamily Ochthiphilinæ"; *Bull. Ill. Nat. Hist. Surv.*, Vol. XIII, Art. 14, pp. 348-357.

with a round black spot on each side of median line, and a very faint dark central on the other tergites. Legs luteous, coxæ and femora more or less suffused with grayish fuscous. Wings whitish hyaline, veins yellowish. Calyptræ white. Halteres yellow.

Head compressed antero-posteriorly, when seen from the side its greatest length exclusive of antennæ is not half as great as its height, frons at vertex less than one-third of the head width, widened anteriorly at base of antennæ almost half as wide as head ; orbits narrow ; ocellar reclinate bristles weak, situated well in front of anterior ocellus ; frontal lunule almost transverse on upper margin, distance from base of antennæ to its upper margin equal to over half its width ; antennæ rather large, third segment disc-like ; arista short, subnude ; cheek as high as width of third antennal segment and about one-fourth as high as eye. Humeral and presutural intra-alar bristles weak ; posterior dorsocentral pair and prescutellar pair of acrostichals long, anterior pair of dorsocentrals very short, close to posterior pair ; sternopleura with one short bristle and some weak setulæ ; scutellar bristles rather short. First posterior cell of wing slightly narrowed apically ; last section of fourth vein about 2·5 as long as preceding section ; inner cross-vein a little beyond middle of discal cell ; outer cross-vein at twice its own length from inner and about 1·5 its own length from apex of fifth vein.

Length, 2-2·5 mm.

Type, male, allotype, and 4 paratypes, Coimbatore, 19th April. " Parasitic on Rain-tree mealy bug " (*Phenacoccus iceryoides*, Green) ; Ramakrishna coll.

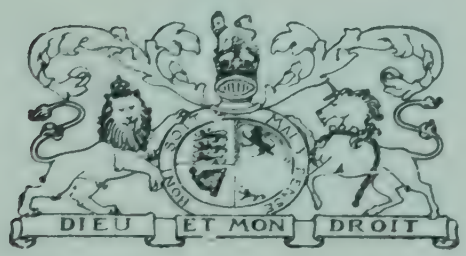
August 1924 ENTOMOLOGICAL SERIES Vol. VIII, No. 8

MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

No. 8. NOTES ON INDIAN ODONATA IN THE PUSA COLLECTION

BY

MAJOR F. C. FRASER, I.M.S



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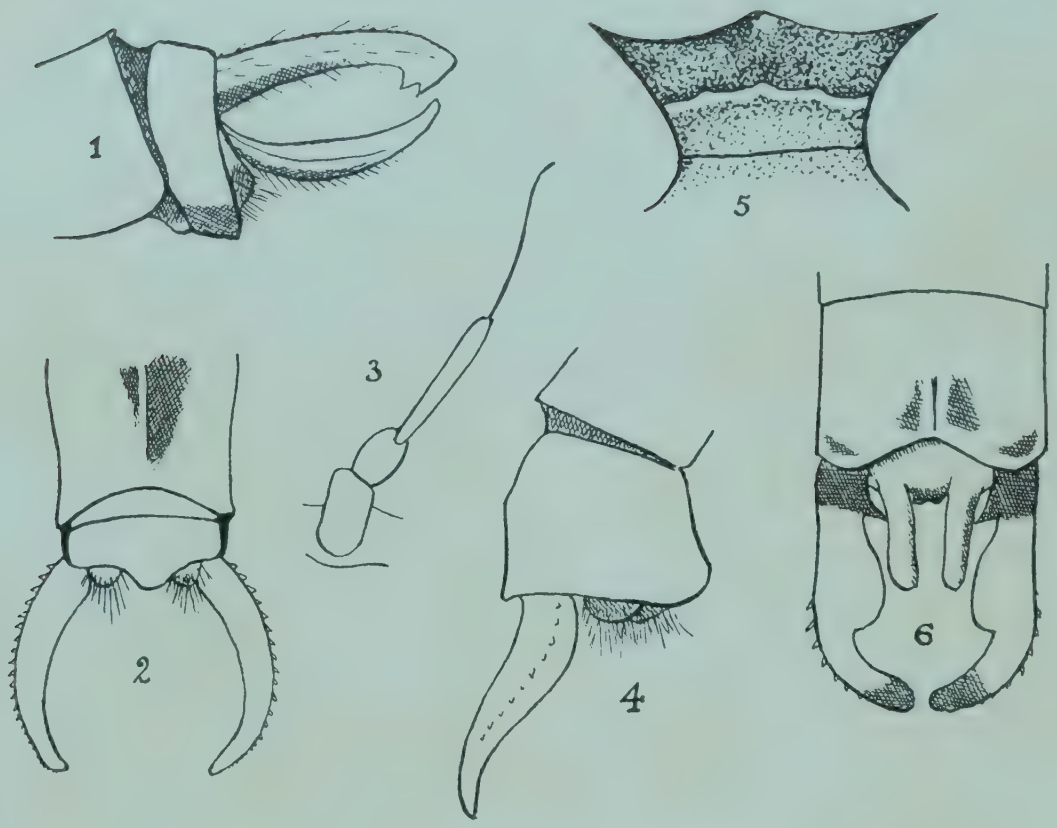
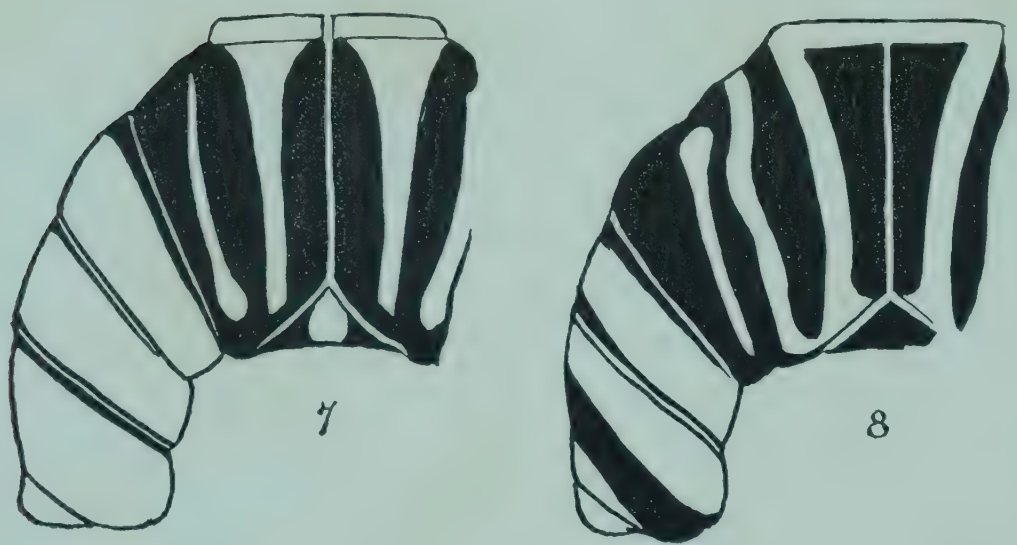




1. Anal appendages of *Tetrathemis aurea*. Male. Side view.
2. Anal appendages of *Philoganga montana* seen from above. Male.
3. Antenna of same.
4. Anal appendages of same seen from the side.
5. Occiput of *Macrogomphus montanus*, Selys, seen from above and a little behind.
6. Anal appendages of *Lestes nigriceps*. Male. Dorsal view.
7. Diagram of markings of thorax of *Macrogomphus montanus*.
8. Diagram of markings of thorax of *Orogomphus preciosus*.

NOTES ON INDIAN ODONATA IN THE PUSA COLLECTION.

BY

MAJOR F. C. FRASER, I.M.S.

[Received for publication on 22nd February 1924.]

SUBFAMILY LIBELLULINÆ.

Tetrathemis aurea, sp. nov.

Male. Abdomen 14 mm. Hindwing 16·5 mm.

Head. Labium yellow bordered with blackish brown, labrum and face black traversed by a broad yellow stripe on postclypeus, frons above and in front and vesicle metallic blue. Occiput black. Prothorax brownish.

Thorax brownish black on dorsum, bright yellow laterally traversed by an anterior and posterior blackish brown stripe.

Legs black, basal halves of anterior pair of femora yellow.

Wings hyaline, suffused with saffron as far as 2 cells proximal of trigone in forewing, as far as pterostigma in the hind, bases more deeply tinted, half way to arc in forewing, as far as arc in the hind. The outer paler area most intense between node and stigma, least intense along posterior border of wing and between node and arc. Pterostigma dark brown, sectors of arc fused for a great length, only 3 cells in loop, 2 cubital nervures in forewing, 3 in the hind, hypertrigones traversed once in all wings, 7 antenodals forewing, 6 in hind, 5 postnodals in all wings.

Abdomen blackish brown, the sides of 2 to 4 yellow, the first mentioned broadly so, less on 3 and still less on 4. On segment 2 the yellow extends upwards over segment forming a basal ring.

Anal appendages (Plate IX, fig. 1) yellowish brown, apices broadened turned down and in the extreme end furnished with two minute spines. Inferior appendage triangular, as long as the superiors.

Genitalia very small, lamina depressed, hamules minute, tumid at base briefly pointed at apex (but somewhat distorted as specimen rather teneral).

Female. Abdomen 17·5 mm. Hindwing 16·5 mm.

Very similar to male, differs as follows:—Saffronation of wings paler, less extensive, only 2 cells beyond in forewing, not quite as far as stigma in hind, area of greatest intensity at node. Four cells in loop.

Posterior lobe of prothorax bordered with bright yellow.

Dorsum of thorax glazed blue metallic, the anterior lateral stripe of blackish brown fuses with dark colour of dorsum and encloses a humeral stripe of yellow. Abdomen similar but segment yellow at the sides.

Vulvar scale of great length, tongue-shaped, extending to end of abdomen.

A single pair from Mergui, Lower Burma, collected by Mr. J. Elton Bott, male, 28th September 1922, female, 2nd September 1922. Both specimens are somewhat teneral and rather flattened by compression in paper packets. Both specimens in the Pusa collection.

The species is very similar to *T. flavescens*, Kirby, and is probably only a subspecies. It differs by having 3 cubital nervures in hindwing instead of 4 and by having only 2 spines beneath apex of superior appendages instead of 4 or 5. The face of *flavescens* is entirely yellow instead of only a transverse stripe.

Sympetrum haematoneura, sp. nov.

Male. Abdomen 26 mm. Hindwing 31 mm.

Head. Labium ochreous, mid lobe black, labrum, face and frons blood red, as also the eyes. Vesicle and occiput dark yellowish brown.

Prothorax brown.

Thorax blood red with a narrow black humeral stripe and a broad similar coloured stripe lying in front and parallel with the postero-lateral suture. Venter largely black. Legs entirely black.

Abdomen blood red above, unmarked, black beneath marked with red, the apical and midventral borders of all segments broadly and the whole of underside of 10.

Anal appendages red, tipped obscurely with dark brown, four or five minute black spines on underside of apex of superiors.

Wings hyaline, reticulation red as far as node, black beyond; pterostigma black, deep reddish brown by transmitted light; nodal index:— $\frac{9\text{-}8\frac{1}{2} \mid 8\frac{1}{2}\text{-}9}{9\text{-}0 \mid 7\text{-}10}$, a single row of cells between *Rs* and *Rspl*.

Genitalia. Hamules of about equal length, the inner curling slightly, the outer running parallel with the lobe which is rather long narrow and rounded at apex.

Hab. A single male from Nilnag, Kashmir, 6,900 ft., collected by T. Bainbrigge Fletcher, 15th August 1923. Resembles *hypomelas* rather closely and

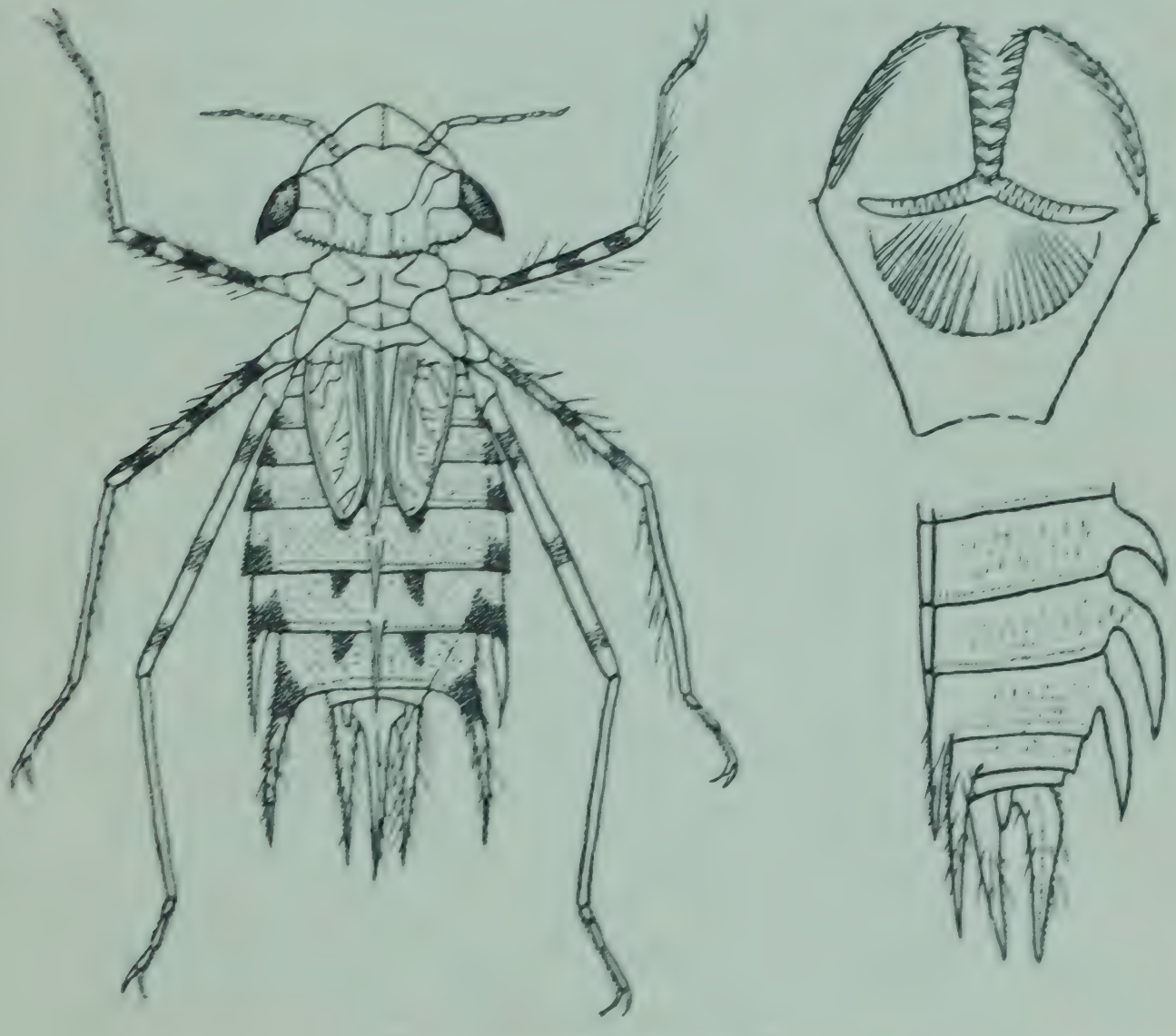
is probably closely related to it. Differs by the reticulation of base of wing, red instead of black, and by the red markings beneath abdomen (entirely black in *hypomelas*). In the latter species also the hamules are of unequal length, the outer being much longer than inner. In *hypomelas* again I find the antenodal nervures of forewing numbering $9\frac{1}{2}$, often $10\frac{1}{2}$ and occasionally $11\frac{1}{2}$, whereas there are only $8\frac{1}{2}$ in the present specimen.

Larva of *Hydrobasileus croceus*, Brauer.

Total length 25 mm. Greatest breadth (abdomen), 10 mm.

Head triangular, the outer angles formed by the eyes which are produced outwards and backwards cone-like and acutely pointed, black. Antennæ long filiform. Occiput broad rounded coated sparsely with short stiff black hairs.

Synthorax comparatively small, wing cases apposed, extending to 6th segment.



Larva of *Hydrobasileus croceus*, Br.

Abdomen flattened beneath, broadly arched above, 6th to 8th segments with very robust backwardly directed spines on the mid-dorsal carina, that on 8 more inclined than the one on 7 and that on latter more inclined than the one on 6, each overlapping the succeeding spine. Laterally strongly convex, segments 8 and 9 ending in very long formidable spines directed straight back and overlapping. Paired pigmented spots on tergites of 7 to 9 and lateral spots on segments 3 to 9. Appendix dorsalis and cerci of great length, spine-like parallel and of about equal length.

Legs long and spidery, anterior pairs coated with coarse hairs, the middle rather more sparsely so, femora with distal medial and proximal bands of pigment.

Mask cupped, mentum rounded and furnished with 11 long setæ converging at their apices, lateral lobes broadly triangular, outer border furnished with 9 or 10 setæ and a moderately long movable spine at apex, apposed borders with a row of 9 sets of spines in twos or threes. Inner borders with smaller single teeth fitting between a row of five smaller spines on middle lobe.

The specimen from which the figure was drawn is almost transparent, pale green in colour and was found lurking amongst water weed. In consequence of its translucency the tracheation of wing cases is depicted with great clarity and the following points are observed :—

The subcostal nervure throws off pairs of tracheolets corresponding to the antenodal nervures of first and second series. Similarly the radius after the node throws off pairs.

The arc is formed by a direct fusion of *M* with *Cu*, the apex of the loop of former coming into contact with the latter without interposition of any cross-nervure. (This is actually to be expected in so highly specialized an insect as *H. croceus*.)

Rs passes between the fork *Mi*, *Mii*, viz., over *Mi* and beneath *Mii*.

Rs throws off three pairs of tracheæ which run parallel to border of wing, *Miv* throws off three unpaired similar branches, the outer one of which soon forks.

Mia forks soon after its origin.

Cuii has a bayonet-like bend corresponding to outer border of loop and then bends abruptly backward to form outer border of apex of loop. At this bend a small branch leaves the main robust stem and runs in continuation of the line of the trachea and after the bend a second branch is sent off to the border of wing.

Cui is merely a fine branch of *Cuii* in this specimen, it is half the calibre of the main stem forming the outer border of loop.

The anal trachea throws off a number of parallel branches which run towards the wing border, all bifurcating at a common level, many of the so-formed branches anastomosing.

Lastly, the minute tracheolets forming the areolets of wing are nearly all plainly discernible. Contrary to this the outer and costal borders of trigones, although plainly made out, show no sign of previous tracheation, merely cuticular thickening. It would thus appear that the whole of the wing reticulation of the wing is laid down on tracheæ or tracheolets, the few exceptions being laid down on cuticular thickenings caused probably by stress and strain throwing the membrane into longitudinal folds. (Easily demonstrated by stretching a handkerchief in any one direction.)

Tramea basilaris burmeisteri, Burm.

A female from Mergui, Lower Burma, collected by Mr. J. Elton Bott, differs from type by the basal marking in hindwing very restricted, occupying only the extreme base of the cubital space and a few cells in the anal triangle, 2 cells wide at the cubital space, extending about one-third the distance from this space to the tornal angle of wing.

Pusa collection.

Subfamily Cordulianæ.

Azuma vittigera, Ramb.

A fine female of this insect from Mergui, Lower Burma, collected by Mr. J. Elton Bott, 1922, now in the Pusa collection.

Abdomen 58 mm. Hindwing 53 mm.

The dark basal rays, deep brown in colour, extend to the 5th antenodal nervure in forewing, to 6th in hind in the subcostal space, in eubital space of forewing as far as arc, and in both cubital and median spaces in hindwing for the same distance.

There is also a faint brown suffusion at the nodes. Nodal index,— $\frac{9\text{-}19 \mid 19\text{-}10}{12\text{-}15 \mid 13\text{-}11}$. The vulvar scale is small, deeply cleft into two triangular processes which overlap the 9th segment.

Thorax brown with a yellow humeral stripe and a lateral which is bordered on either side by darker brown. Abdomen does not differ from *cyanocephala* in markings.

Macromia cupricincta, sp. nov.

A single male from Mokpalin, Thaton District, Burma, taken about 11-30 A.M., hawking low over a shady jungle path. Coll., J. Elton Bott, 10th May 1923.

Male. Abdomen 43 mm. Hindwing 38 mm.

Head. Lips, face and frons all uniform brownish yellow ; eyes probably emerald green during life ; occiput dark brown.

Thorax reddish brown, upper part of dorsum obscurely metallic green, humeral stripe absent, a rather broad mediolateral stripe of yellow on each side bordered narrowly in front and behind by blackish brown.

Legs blackish brown, proximal ends of femora reddish brown.

Wings hyaline, very palely enfumed, a very short dark brown ray in the subcostal space of all wings, extending outward not nearly as far as the first antenodal nervure ; membrane white ; stigma blackish brown, unbraced, over 1 to 2 cells, outer end much more oblique than inner ; nodal index $\frac{6\text{-}15 \mid 14\text{-}5}{7\text{-}12 \mid 11\text{-}8}$; hypertrigones traversed four times in forewings, twice in the hind ; 5 cubital nervures in forewing, 2 to 3 in the hind, 6 cells in loop. Tornus very acute and prolonged.

Abdomen. Segment 1 reddish brown, 2 with the basal half yellow, apical half dark reddish brown, 3 with rather more than the basal half yellow, the apical part black, the basal part of dorsum diffusely brown, this graduating into the yellow, 4 to 6 with basal half yellow, apical half black, 7 with rather more than the basal third bright yellow, the remainder reddish brown, segments 8 to 10 and anal appendages dark ochreous, 10 strongly keeled, the basal part of keel prolonged into a rather long thin and very finely pointed dorsal spine.

Anal appendages. Superior long and tapering, as long as the two last segments taken together, curling gently inward and downward, furnished at the middle of outer side with a robust blackish spine, apex finely pointed and turning slightly up. Inferior slightly longer than superiors, narrowly triangular, curling up at apex.

Genitalia. Lamina very depressed, deeply and narrowly cleft, hamules broad at base, rapidly narrowing to a long, fine hook curled somewhat like a button-hook, lobe long narrow tongue-like, overlapped by the hamules.

This new species belongs to Group *cincta* ; it has the delicate and small build of *M. cincta* but differs from that species by its general reddish brown colouring and by having the abdomen ringed instead of spotted. On the other hand, it resembles it by the needle-like spine on segment 10 and by the shape of its genitalia, so that it may be merely a local race of *cincta*.

Subfamily Chlorogomphinæ.

Orogomphus preciosus, sp. nov.

Female. Abdomen 57 mm. Hindwing 47 mm.

Head broad from side to side, eyes separated by about 1·5 mm., frons as high as occiput. Labium pale brownish yellow, labrum ochreous, anteclypeus dark brown, postclypeus bright citron yellow, frons brown in front, black above, the crest finely yellow, vertex black, occiput yellow fringed with long brownish black hairs.

Prothorax brown.

Thorax black marked with bright yellow as follows:—a complete mesothoracic collar, an antehumeral and humeral stripe both extending full length of dorsum and narrowly confluent above thus enclosing an oblong spot of the ground colour. The antehumeral stripe expanded above and connected below with the mesothoracic collar. A very narrow posthumeral stripe lying close to and parallel with the humeral stripe, two very broad stripes on the sides narrowly separated by a fine black line, broadly separated from the posthumeral. Finally the extreme ventro-posterior border of metepimeron. Beneath yellow striped obliquely with black. (Plate IX, fig. 8.)

Legs black, anterior femora striped with yellow posteriorly.

Wings hyaline, saffronated at bases, in forewing as far as outer end of trigone at the costa, as far as its posterior angle at the border of wing, in hindwing rather less extensive, only as far as trigone and for a few cells in anal triangle. Greatest breadth of wing at distal end of *Cuii* 15·5 mm. Trigone of hindwing with costal and proximal sides equal, outer side slightly longer, in forewing costal side slightly longer than outer and both half as long again as proximal. Loop with 11 cells, nodal index:—$\frac{13\text{–}20}{16\text{–}20}\Big|\frac{22\text{–}13}{20\text{–}17}$, 7 cubital nervures in all wings, 4 nervures in hypertrigones of forewings, 3 in the hind, *only* 1 *median nervure in all wings*, a basal antenodal nervure of second series in all wings, pterostigma over $2\frac{1}{2}$ cells, black narrow 3·2 mm. non-braced. Membrane dark brown. Trigones of forewings traversed twice by vertical nervures, in hindwing by three nervures which meet at centre of trigone.

Abdomen tumid at base, of about even width and cylindrical from 3 to base of 7 where it is somewhat dilated, 8 as broad as 7, 9 and 10 narrowing and decreasing in length progressively. Black marked with yellow as follows:—Segments 1 to 3 rather broadly on the sides, 2 with a pair of large transverse spots on dorsum at middle of segment and an obscure pair at apical border, 3 with similar but smaller spots, 4 to 7 with only the apical pair of

spots which decrease in size from 4 to 6 but larger and confluent over dorsum on segment 7. Ventral borders of 8 and 9 narrowly yellow.

Anal appendages very short, black, separated by a large conical process as long as themselves.

Vulvar scale very short, rudimentary, a mere convexity of the apical border of segment 8.

Hab. A single female from Sikkim, 4,000 ft., Mangpu, 10th May 1922.

I think it is fairly obvious that the male described by Laidlaw (*Rec. Ind. Mus.*, Vol. XI, p. 198; 1915), as the male of *speciosus* is really the male of this species as the two come from the same district, whereas *speciosus* comes from Burma. The venation of the two agrees rather more closely than does that of the male with *speciosus* and it is very significant that, whereas there are 2 median nervures in the latter, there is only 1 in all wings of the new species and Laidlaw's male.

Distinguished from *speciosus*, to which it is closely related, by the bright basal saffronation of wings, by having only 1 median nervure to all wings, by having 3 cells in trigone of forewings, labrum yellow instead of black marked with yellow and by the two posterior stripes on sides of thorax of even width (the middle stripe the broadest in *speciosus*).

Distinguished from *splendidus* by the basal saffronation of wings far less extensive, by the apices of wings uncoloured, by the postnodal nervures more numerous (17 instead of 14) and by the labrum all yellow instead of all black. From *atkinsoni* the difference in shape of head and abdomen and saffronation at bases of wings will serve to differentiate it.

Type in the Pusa collection.

Subfamily Gomphinæ.

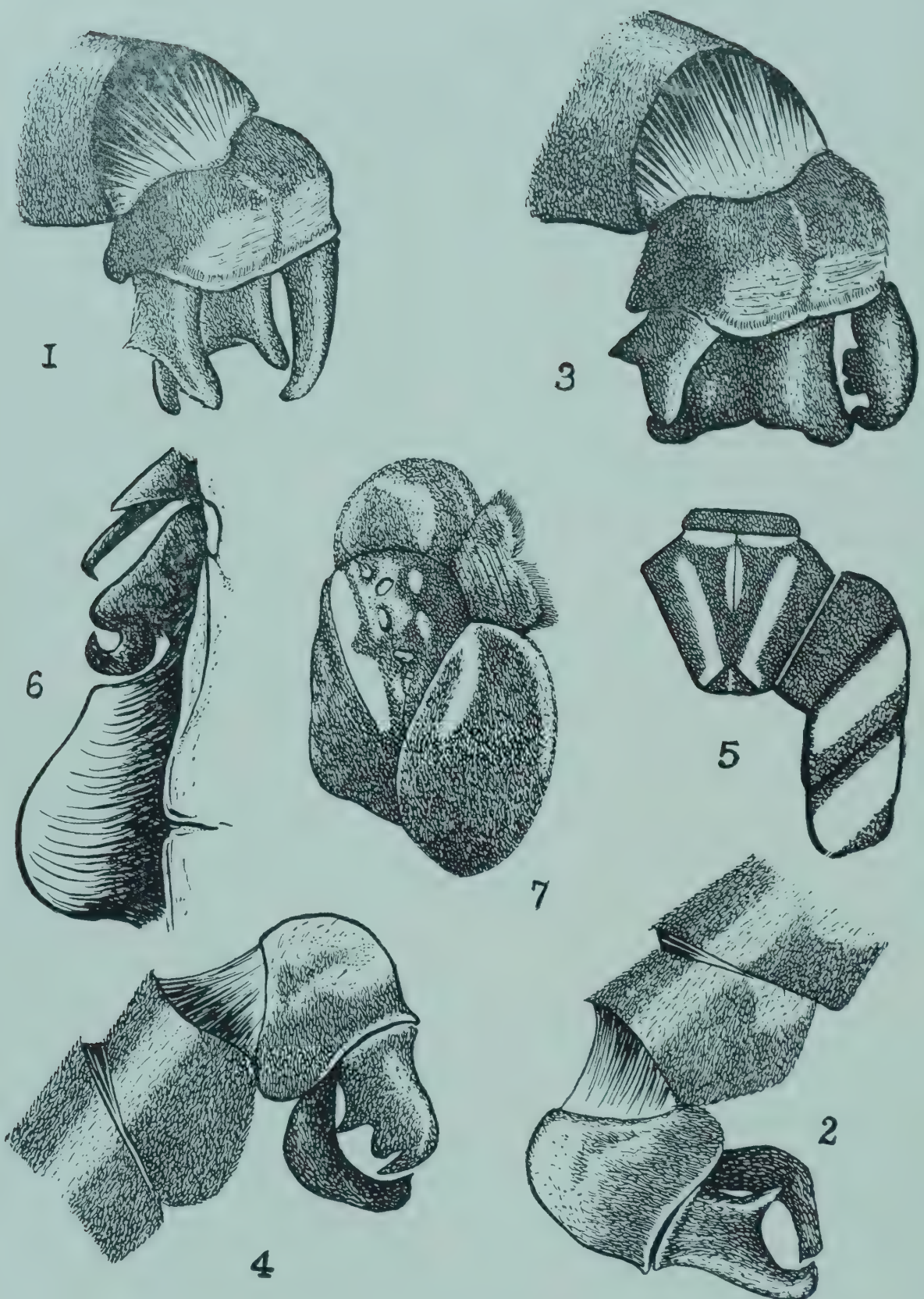
A new species of *Hagenius* (*H. nigricolor*) from the South Shan States.

Only two species of the genus *Hagenius* have been described, *H. gigas*, Mart., from Tonkin, and *H. brevistylus*, Selys, from North America, which, together with the third species to be described, all agree in their general facies, rather small head, long narrow wings, heavily built body and curiously shaped short robust anal appendages. The genitalia of *gigas* have not been described but those of *brevistylus* and the new species agree so closely that I have been unable to find any points of divergence.

Hagenius nigricolor, sp. nov.

Male. (Female unknown.) Abdomen 54 mm. Hindwing 49 mm.

Head. Eyes dark olivaceous brown, lips, bases of mandibles, clypeus, the frons in front, vertex and occiput glossy black, upper surface of frons



1 Latero-dorsal view of anal appendages of *Hagenius nigricolor* sp. nov.
2. Side view of same.
3. Latero-dorsal view of anal appendages of *Hagenius brevistylus*, Selys.
4. Side view of same.
5. Thoracic markings of *Hagenius nigricolor*.
6. Genitalia of same viewed in profile.
7. Head of same, latero-dorsal view showing the curious shape of occipital plate.

bright greenish yellow, its base narrowly black, this colour extending for a short distance forwards in the floor of the sulcus.

Occiput of remarkable shape (Plate X, fig. 7), projecting squarely back as a thick plate which overhangs the prothorax, its posterior border slightly notched in the middle and densely fringed with short stiff black hairs, its upper surface coarsely corrugated transversely and slightly hollowed out. Vertex raised into two prominent points closely simulating the condition found in Libellulines.

Prothorax velvety black marked with two small yellow points on the mid-dorsum.

Thorax black marked with yellow as follows :—A complete mesothoracic collar confluent with a lower stripe on the lower half of the mid-dorsal carina, narrow antehumeral stripes slightly divergent in front but not confluent with the mesothoracic collar, the upper ends turned out slightly at an obtuse angle. No vestiges of a humeral stripe. Laterally a rather narrow stripe well in front of the spiracle and a second covering rather more than the posterior half of the metepimeron. Tergum and attachments of wings spotted with yellow. (Plate X, fig. 5.)

Legs black, of great length, hind femora extending back nearly as far as the apical end of segment 2, furnished with a row of closely set, widening and lengthening spines towards the distal end, tibial spines of same legs very closely set, relatively short but very thick and robust, the mid-femora with spines more closely set and a few longer ones at the distal end. Hooks of tarsal claws very minute, situated near the middle of claws.

Wings long and narrow, resembling those of *Petalura* superficially, hyaline ; pterostigma elongate, dark brown between black nervures, braced, over 6 to 7 cells, 6 mm. long ; membrane nearly obsolete, hyaline ; costa finely yellow ; 3 rows of cells between *Mi* and *Mia* ; 2 cubital nervures in all wings, all trigones traversed once, the trigone of hind wing longer and narrower than that of fore, its outer side markedly angled where the accessory nerve takes off ; 2 rows of postanal cells in forewing, 5 in the hind, where there is a distinct loop of 3 cells ; anal triangle of 3 cells ; a basal antenodal nervure of the 2nd series in all wings ; nodal index $\frac{13\text{-}18}{14\text{-}14}\ \frac{20\text{-}12}{13\text{-}15}$.

Abdomen black marked with yellow as follows :—The sides of segment 1 and 2 broadly, this colour running up on the dorsum along apical margin of segment 2, a fine obscure mid-dorsal line on segment 2, 3 with the basal portion of sides yellow, 4 to 7 with basal lunules separated above by the dorsal

crest, 8 with about the basal half yellow, rather more than half on the sides, 9 with a small baso-lateral spot, 10 wholly black.

Segments 1 and 2 very tumid, 4 to 6 slim and cylindrical, 7 gradually dilating apicalwards, 8 and 9 dilated to about double the width of 7, with short foliate lateral processes, 10 short and square, its dorsum rounded.

Anal appendages (Plate X, figs. 1 and 2) black, very short, barely longer than segment 10, the inferior only slightly shorter than the superiors. Superior broad for rather less than the basal half, then abruptly tapering to a point and converging gently inwards towards one another, the apices not however meeting. At the point where they begin to taper, a robust ventral spine directed downwards. Inferior curling upward, squared, a robust digitate process springing from each outer corner and curling upward and, at the apices, a little outward.

Genitalia (Plate X, fig. 6). Lamina depressed, acutely notched in the middle, as if cut with a knife ; inner hamules two thin stillettes running back and downward, converging on one another, their extreme apices curled a little outward. Outer hamules very broad, long and robust, the ends squared, a robust hook, shaped like a tiger's claw, springing from the outer corner ; vesicle enormously inflated, rounded, shiny.

Distribution. A single male from the Southern Shan States, collected by Captain Drummond and kindly sent to me by Mr. C. M. Inglis. Collected on 23rd September 1923. (The specimen is rather broken up.)

Differs from *H. brevistylus* Selys, by its rather smaller size, by the face and lips entirely black instead of bright greenish yellow, by the entire absence of humeral and narrow medial lateral stripes (only two stripes in *nigricolor*, two broad and a medial narrow yellow stripe in *brevistylus*), by having 2 cubital nervures instead of only 1, by the longer and less closely-set distal spines on hind femora and by the superior anal appendages slightly longer than the inferior instead of slightly shorter. The appendages differ also in shape (Plate X, figs. 3 and 4).

The occipital plate is only slightly produced backwards in *brevistylus* and has not the striking character seen in *nigricolor*. As Martin does not mention the occiput in his description of *gigas*, it is to be presumed that it has only normal characters as in *brevistylus*.

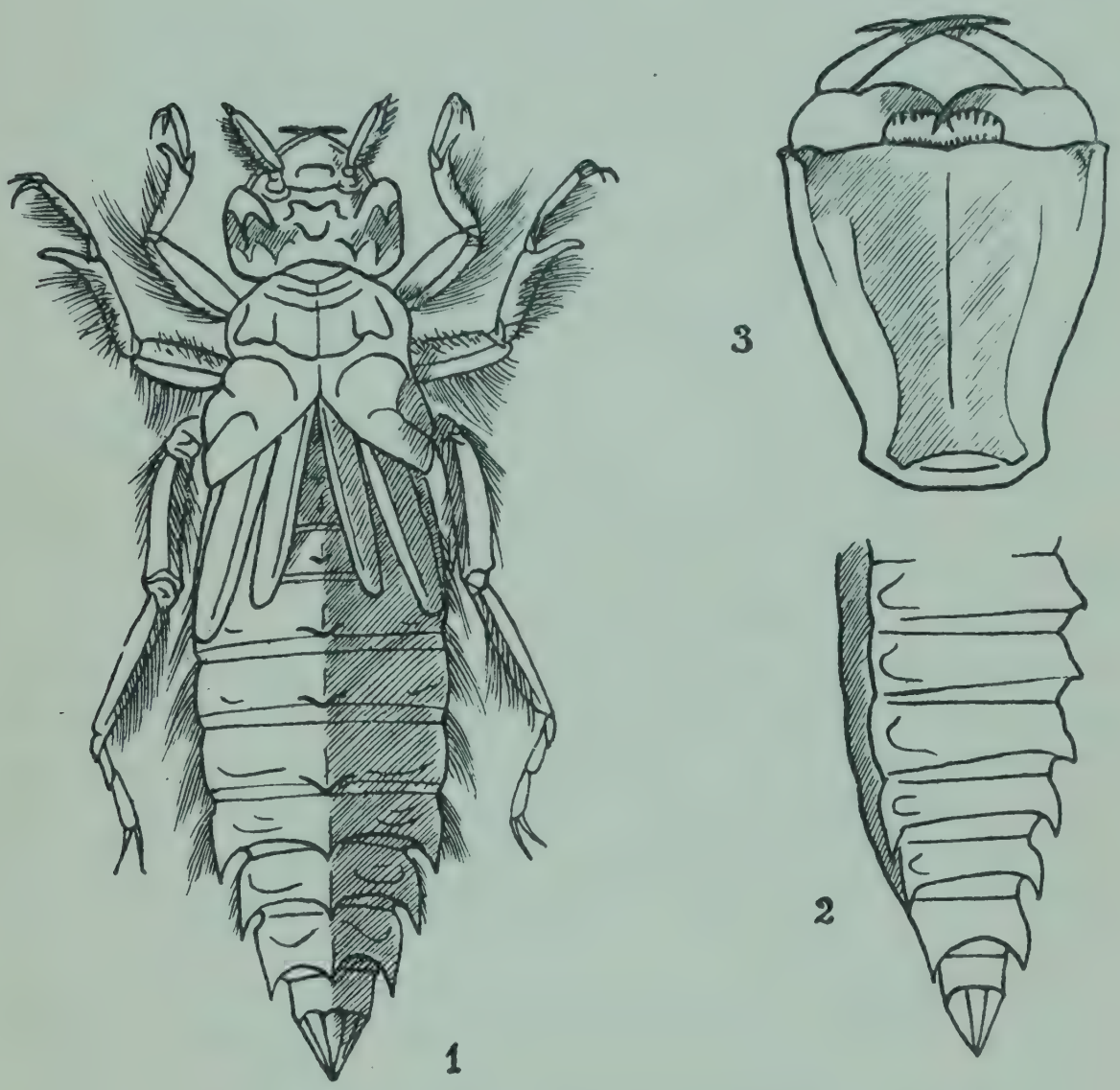
From *H. gigas*, Mart., it differs by its much smaller size (abdomen only 54 mm. instead of 71 mm.), by the antehumeral stripe not confluent with the mesothoracic collar, by a single black stripe on sides of thorax instead of 2 and by the inferior anal appendage nearly as long as the superiors instead

of only one-third as long. The appendages are also quite different in shape.

It is to be remarked that this is the first species of the genus to be reported from within Indian limits and the second from the old World.

Exuvia of *Megalogomphus hannyngtoni*, Fras.

Head broad roughly triangular, eyes slightly produced and projecting forward, antennæ four jointed, the scape and pedicel very short, first distalia



Larva of *Megalogomphus hannyngtoni*, Fras.
1, Larva ; 2, Side-view to show dorsal armature ; 3, Mask.

robust long forming greatest part of antennæ, apical segment very short and minute.

Mask squared but rather longer than broad, lateral lobes massive, apex prolonged into a very robust incurved spine armed with four to five teeth on its inner border, movable hook very long, overlapping, naked.

Synthorax broadening from before back, upper surface broadly mammillated or bossed, wing cases widely divergent extending to apical border of segment 4.

Legs short and robust, femora and tibiæ with a long fringe of coarse hairs on outer surface, tarsi of middle and forelegs similarly so. Anterior two pairs of tibiæ with the distal ends prolonged into robust obtuse spines adapted for excavating.

Abdomen fusiform tumid strongly keeled, tergum arched, venter flattened, mid-dorsal carina of 2nd to 9th segments armed at the apical end, beginning with a small tubercle on segments 2 and 3, gradually lengthening to a robust spine from 4 to 9.

On segment 6 the spine slightly imbricated backwards, strongly so on 7, 8 and 9, these three segments also furnished laterally with backwardly directed spines. Segments 4 to 7 with a lateral fringe of coarse hairs very similar to those on the legs.

Appendix dorsalis and cerci of about equal length, converging to a point.

Total length 46 mm. Breadth at widest part (abdomen, segments 4-5) 13 mm.

This enormous exuvia was discovered in May 1917 by the late Mr. Hannyngton, I.C.S., at Mercara, Coorg. The generic position was determined by a reading of the venation plainly visible on the wing cases. Subsequently the imago was discovered at Hallery, Mercara, by myself and as this is the only species known from Southern India it is to be presumed that the exuvia and imago are conspecific. (Mr. Raymond of Hallery Estate informs me that Mr. Hannyngton, who was then Commissioner of Coorg, spent a good deal of his leisure hours collecting Lepidoptera at Hallery and it may be that the exuvia was discovered by him during one of these visits.)

On the 16th February this year, whilst dredging for larvæ in a small stream two miles beyond Bettageri village, on the Bhagmandala road, Coorg, I was fortunate enough to secure five larvæ corresponding to the exuviæ of *Megalogomphus hannyngtoni*, described above. These were buried fairly deeply in sand at the bottom of a pool at the foot of a rapid. (Such places are always found prolific with Gomphine larvæ.) These were conveyed back to Mercara and placed in shallow dishes with about one or two inches of sand at the bottom.

They remained motionless until near dark when they suddenly began to burrow and quickly disappeared from sight, even the cerci being obscured. During two months they never once showed themselves above the sand although occasionally the dorsal ridge of one or more would be partly visible. Other dragonfly larvæ were given them for food but remained unmolested until I introduced burrowing Gomphine larvæ, and fresh-water shrimps. It was then seen that the larvæ obtain their food by searching for it in the sand, for the surface of the sand was soon strewn with fragments of partially devoured larvæ and shrimps.

The first specimen, a fine female, emerged on the 8th April, crawling out of the water and clinging to the side of its cage just above the water's surface. Emergence took place at 6-30 A.M., but the wings and abdomen were not fully grown until 10 A.M. The insect took quite half an hour to leave its exuviæ and from its low position, it seemed that it had not left sufficient room for its wings to hang and dry. However, both wings and abdomen were held horizontally out, parallel to the earth during this process and in spite of their softness, developed and dried perfectly straight. By one o'clock the pattern was fully developed on the body and by 4 P.M. the ground colour was quite black and the yellow markings beautifully contrasted. Markings and colour mature with great rapidity in most Gomphines.

It is to be remarked that, with the exception of the co-type female, this specimen is the only other female of *hannyngtoni* known.

Macrogomphus montanus, Selys.

It is interesting to report the capture of a female of this species, Pusa, Bihar, 26th June 1923. It is slightly teneral which may explain some slight increase in extent of the yellow markings. The labrum is yellow framed narrowly in and traversed narrowly by black. The antehumeral stripes extend as far up as the alar sinus and are squared against it, they are again broader than usual. The humeral (juxta-humeral) stripes are broader and extend nearly to lower front of dorsum.

The curious shape of the occiput of this species and the yellow markings of thorax are depicted on Plate IX, figs. 5 and 7.

Lamellogomphus cacharicus, sp. nov.

A single female from Dilkhoosh, Cachar, coll., July 1921.

Female. Abdomen 42 mm. Hindwing 38 mm.

Head. Labium dirty yellow, labrum black marked with a small comma-shaped spot at each outer end, bases of mandibles yellow, ante- and post-

clypeus glossy black, the latter marked with a small yellow spot on each side against the eyes, frons black marked with a broad yellow stripe along the crest, vertex and anterior part of occiput black, the posterior part of latter dark brown, simple, straight, no armature, fringed with black hairs.

Prothorax black marked with yellow as follows :—a small spot on each side, the posterior lobe narrowly, two small points on mid-dorsum and a narrow anterior collar.

Thorax black marked with yellow as follows :—a narrowly interrupted mesothoracic collar, antehumeral stripes confluent with the latter and forming inverted figure "7"s, humeral stripe entirely absent. Laterally a broad posthumeral stripe of yellow and the whole of the metepimeron the same colour. These two yellow areas divided by a broken black stripe.

Legs black, coxæ and trochanters yellow, the anterior femora striped with yellow on inner side. Hind femora with a row of short robust moderately closely-set spines.

Wings hyaline, pale rays of saffron in subcostal and cubital spaces extending outward as far as the arc ; pterostigma brown, over 5 to 6 cells, braced robustly ; membrane obsolete ; 1 to 2 rows of cells between *Mi* and *Mia* at distal end of pterostigma ; nodal index $\frac{10\text{-}15 \mid 14\text{-}10}{10\text{-}10 \mid 11\text{-}11}$; 1 cubital nervure in all wings ; 1 to 2 rows of postanal cells in forewing, 4 rows in the hind.

Abdomen black marked with yellow as follows :—a narrow mid-dorsal stripe tapering from segment 1 to the transverse suture on segment 3, the sides of all these three segments broadly yellow, but narrowing progressively from 1 to 3 and not quite extending to apical border of latter. The dorsal and lateral stripes separated by a broad black stripe on either side, segments 4 to 7 with broad basal rings incomplete below and covering nearly one-fourth of segments, 8 with a small baso-dorsal spot, 9 and 10 yellow laterally.

Anal appendages dark brown, minute, pointed.

Vulvar scale short, rounded, not projecting. (This organ crushed and not very easily made out.)

The specimen is slightly teneral and the black colouring, especially of abdomen, not completely matured.

This female is distinguished from *acinaces* and *nilgiriensis* by the mesothoracic collar and antehumeral stripes being confluent. The same character and the absence of a spine on the occiput will distinguish it from *malabarensis*. From Laidlaw's *Onychogomphus* sp. from the Garo Hills, the absence of dorsal spots on segments 3 to 5 and the fusion of the antehumeral bands with the

mesothoracic collar serve to distinguish it. From *inglisi* and *biforceps*, the last character and the entire absence of humeral stripes separate it. From *drummondi*, which it resembles somewhat, the following points of difference are to be noted,—segments 9 and 10 are yellow laterally instead of dorsally, the humeral upper spot seen in *drummondi* is absent, the occiput is black instead of yellow, and lastly the lateral medial black stripe in *drummondi* is very broad and unbroken.

Subfamily Aeshninæ.

Gynacantha apicalis, sp. nov.

Female. (Male unknown.) Abdomen 45 mm. Hindwing 40 mm.

Face and lips pale yellowish brown, anterior border of frons and the sulcus above diffusely brown, the area on either side bluish white, occiput yellow finely bordered on either side behind with black.

Prothorax and thorax pale uniform brown, possibly green during life.

Legs brown, femora bluish white on outer side.

Wings hyaline, apices broadly tipped with brown from about middle of pterostigma, latter yellow braced, nodal index, $\frac{13-14 \mid 16-12}{14-11 \mid 11-14}$, 4 cells in all trigones.

Abdomen blackish brown above, bluish laterally especially from segments 1 to 4, segment 2 has a pair of transverse blue stripes at its middle widely separated by the mid-dorsal carina and a pair of apical blue spots.

These stripes and spots repeated on segments 3 to 7 with an additional narrow blue basal ring formed by an upper extension of the lateral blue, segment 8 with a large triangular blackish brown spot laterally, 9 with a much smaller spot, 10 dirty white.

Described from a single specimen in the Pusa collection, from Lyallpur, collected by G. R. Dutt, October 1921. Distinguished from other species of the genus by the apical marking of wings and also by the extensive blue markings of abdomen.

Aeshna mixta, Latr.

From Srinagar, Kashmir, Mr. Bainbrigge Fletcher sends a new race of this insect which differs from type by having the lateral thoracic bands of thorax bright azure blue instead of greenish yellow. Latreille's original description says, –" deux bandes de chaque côté d'un jaune verdatre " and specimens from Europe which I have compared with the Srinagar series conform to Latreille's description in having the lateral bands yellowish instead of blue as in the Kashmir specimens.

Prothorax black, the anterior lobe, sides and mid-dorsal area pruinosed white.

Thorax black marked with a reddish brown humeral stripe, the sides low down and a stripe between the two lateral sutures yellowish green. The dorsum internal to the humeral lines obscurely marked with two dark green metallic stripes whose outer border is quite straight.

Legs yellow, femora and tibiæ striped narrowly with black, tibial spines moderately long.

Wings hyaline, pterostigma pale brown, four times as long as broad ; 11-12 postnodal nervures to forewing, 9-10 in the hind ; quadrilaterals equal, *ac* midway between antenodals.

Abdomen yellowish brown broadly marked with black or metallic green as follows—segments 2 to 6 and the basal half of 7 metallic green, the remainder matt black, segment 2 with the green stripe split mid-dorsally by a fine black line for its basal three-fourths and widely thereafter.

All stripes expanding apically and joining a fine apical black ring.

Anal appendages (Plate IX, fig. 6) yellowish brown, superior black at extreme apex and base. A short robust spine at inner side of base of superiors after which there is a broad expansion occupying middle third of appendix which then contracts again. Apical third sharply angulated in and down, minutely spined on its outer border. Inferior appendages small, ungulate, about half the length of superiors.

Female. Abdomen 30-32 mm. Hindwing 21-22 mm.

Rather similar to the male, differs as follows,—black on head more restricted and with metallic reflex, back of head reddish brown, not pruinosed. Prothorax pale brown with two fine brown lines on mid-dorsum.

Thorax pale brown with two fine straight metallic green stripes on dorsum. No black markings. Segments 1, the sides and apex of 9 and the whole of segment 10 pale brown. Anal appendages brown conical pointed.

Described from a single male and two females from Pusa, collected by Mr. T. Bainbrigge Fletcher, July 1922. Type in Pusa collection.

The species is closely related to *L. viridula* but differs from it by its longer pterostigma and by the extensive black markings on head and thorax. (I have never observed melanism develop in *viridula*.) The anal appendages are closely similar in shape but differ in colour and the inferiors are slightly longer and narrower.

Libellaginæ.

Philoganga montana, Selys.

A male of this very rare and archaic insect, which has offered so much difficulty to systematists, was taken by Mr. Bainbrigge Fletcher at Shillong on 5th June 1920. It is of interest to note that the insect was taken at rest with its wings wide open in the horizontal plane. No other specimen was seen although a prolonged search for more was made. *

The anal appendages and antenna of this insect are depicted (Plate IX, figs. 2, 3 and 4).

* A good series, including both sexes, was taken in May and June 1921 at Shillong, where this insect was found in small numbers in two very restricted localities.—T. B. F.

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MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

No. 9. ON NEW AND OLD ORIENTAL CICINDELIDÆ

BY

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AGRICULTURAL RESEARCH INSTITUTE, PUSA

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Cicindela rhytidopteroides, nov. spec.

IN sectionem VII, 1 collocanda (W. Horn in "Wytsman": Genera, p. 285); differt habitu *Prothymam* (*Rhytidophœnam*) *limbatam* sub sp. *inornatam* m. imitante :—Labro brevi nigro-metallico in disco late flavo (♂ ♀); capite, pronoto, prosterno, meso-episternis, abdominis disco nudis. Partibus orbitalibus grossim sparsimque striatis; prothoracis lateribus sat rotundatis, pronoto modice plano dense subtiliterque sculpto; elytris modice convexis ante medium, dense grossimque punctatis punctis insculptis posticem versus gradatim minoribus levioribusque. Pro-episternis ad coxas, meso-epimeris et meta-episternis et laterali metasterni parte dense setosis; femoribus sine pilis curvatis.

Long. 7-7·5 mm. (sine labro).

1 ♀ ♂ : Bengal.

Differt a *Prothyma limbata inornata* statura tota minore gracilioreque; labro, præcipue ♂, paullo breviore (♀ quoque flavomaculato); oculis magis prominentibus, vertice angustiore; pronoto paullo minus convexo, lateribus magis rotundatis; elytris æqualiter sed totis subtilius punctatis, angulo suturali magis rectangulari; 4 primis antennarum articulis pedibusque cœruleo-viridibus; elytrorum margine laterali angusto cyaneo; corpore subtus cyaneo.

The resemblance to *Prothyma limbata* is, at the first view, surprising. The two specimens I possess are in rather bad condition and do not bear a "fixed" hair at the 4 anterior trochanters but as they show at their top

" foveiform " impression, the existence of " fixed " hairs seems me to be certain.

Cicindela pseudo-nana, nov. spec.

Species novam sectionem in tribu VII orientali (W. Horn in " Wytsman " : Genera, p. 285) constituens, inter sectionem 15 et 16 collocanda : differt a reliquis huius tribus septimæ sectionibus labro brevi metallico submarginaliter piloso ; palpis tenuibus, sed non extraordinariter prolongatis ; pronoto supra non convexo, solummodo ad angulos anticos setosulo, subtilissime sculpto (nec " median-eingeschachtelt," nec " quernadelrissig "—sculpto) ; abdominis disco punctato-piloso ; femoribus maxima ex parte non-metallicis, sine pilis unciformibus.

Cicindelæ nanæ, Schaum, similis, differt statura paullo majore, longiore pro-episternis solummodo ad marginem anticum setosis ; abdominis basi-lateraliter nudo. Coloratione magis cœrulescente quam viridescente (sordide) ; elytris ad extremum marginem lateralem tenuiter purpureo-cyaneis splendentibus. Signatura simili, sed puncto infra-humerali paullo majore, ante-apicali paullo minore, stria transversa media ante medium abbreviata. Long 6-6·5 mm. (sine labro).

1 ♂, 2 ♀ (alterum in coll. Moser) : Luzon (Mt. Banahao (IV-VI 1914 : Coll. *Bœttcher*). A Dom. Maindron-Kerremans et a Dom. Moser mihi liberalissime data.

It differs sufficiently from *Cic. nana*, Schaum, by the pubescence of the pronotum, of the pro-episterna and the base of the abdomen. The elytra show inside of the narrow bright violet-reddish stripe a light blue border that runs, by and by, into the greyish greenish dirty colouration of the disk.

Cicindela pseudo-interposita, nov. spec.

Cic. virginea interposita m. simillima, differt elytrorum superficie nigro-violaceo-purpurascente, spina suturali ♂ ♀ longiore ; pronoto breviore, perparum minus glabro, ad angulos anticos satis quibusdam ornatis ; pro-episternis paullo minus sparsim, meta-episternis totis, abdominis 2 primis sternitis lateraliter anguste setosis ; ♂ penis apice extremo leviter curvato. Antennarum articulo 3 ♀ et 4 ♀ distaliter et mandibularum superficie in medio viriditer indutis. Long 9 mm. (sine labro).

♂ ♂ ♀ ♀ ; Insula Panaon (December 1915 : coll. *Bœttcher*).

The place, where generally in the ♀ the " mirror " is situated (anterior disk), is only indicated by just a little lighter colouration. Sometimes the upperside of head and the pronotum bluish-green.

Prothyma hopkinsi confluente-angustata, nov. subspec.

Differt a forma prioritatis labro paullo longiore. ♂ ♀ pronoto angustiore, minus profunde sulcato, minus convexo, magis cylindrico, densius et magis irregularius ruguloso ; elytris angustioribus, densius sculptis, præcipue pone medium magis rugulosis (fere ut in subsp. *rotundato-cuprascens* m.), margine toto læte cœruleo, signatura aut tota ad marginem anguste irregulariterque confluente (solummodo vix ante apicem evanescente) aut macula marginali media ad marginem evidenter dilatata (in utroque specimine hac macula media brevissime intus hamata). Coloratione simili, superficie tota magis opaco-cuprea ; episternis totis cyaneis.—Long 11-13 mm. (sine labro).

1 ♀ ♂ ; Insula Negros (Cuernos Mts., Philippines : coll. *Baker*).

As *Prothyma hopkinsi* m. is so extraordinarily variable, I believe that the new form is but a subspecies of it. It is remarkable by its narrow shape, the " cylindrical " prothorax, the dense punctation of the elytra becoming confluent in form of wrinkles at their posterior half. The yellow marginal markings of the elytra show a tendency of getting connected.

Therates batesi testaceipennis, nov. subspec.

Differt a forma prioritatis elytris testaceis. Long 7 mm. (sine labro).

1 ♀ ; Sandakan (Borneo : coll. *Baker*).

Differs from the species as described by J. Thomson by the testaceous colouration of the elytra : the discoidal convexity of them is lighter yellow.

Therates dormeri m. [wrongly described from " Borneo " : I know now that it comes from Assam (Patkai Hills) and N. Manipur (*Doherty*)] is but a race of *Therates hennigi* m. from the Khasia and Garo-Hills (3,500 ft. : VII, " above Tura "), showing the yellow colouration of the elytra and of the border of the abdomen less developed. In the " priority " form (*hennigi*) all yellow patches of the elytra are confluent near the suture and the anterior blackish discoidal spot is completely missing.